the OIL AND GAS JOURNAL

JANUARY 5, 1959

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Oil Starts '59 With Its House in Order

Stocks are in good shape at year's end, and demand is showing healthy comeback . . . . . **p. 67**

Methane Tanker Ready to Make History

First cargo of liquefied natural gas will leave the Gulf Coast this month for England . . . . . **p. 76**

New Congress Will Look Hard at 27½% Depletion

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Economy Cars Popular, But Affect Oil Little

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CHARTS TO SIMPLIFY SEPARATOR-CAPACITY CALCULATIONS

THE SKILL OF SERVICE

The true composition of Service is the integration of many skills.

At Halliburton, the formula for Service is the meshing of talents and facilities that help to assure customer satisfaction.

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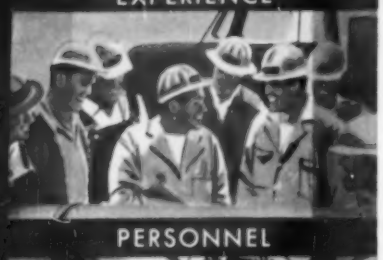
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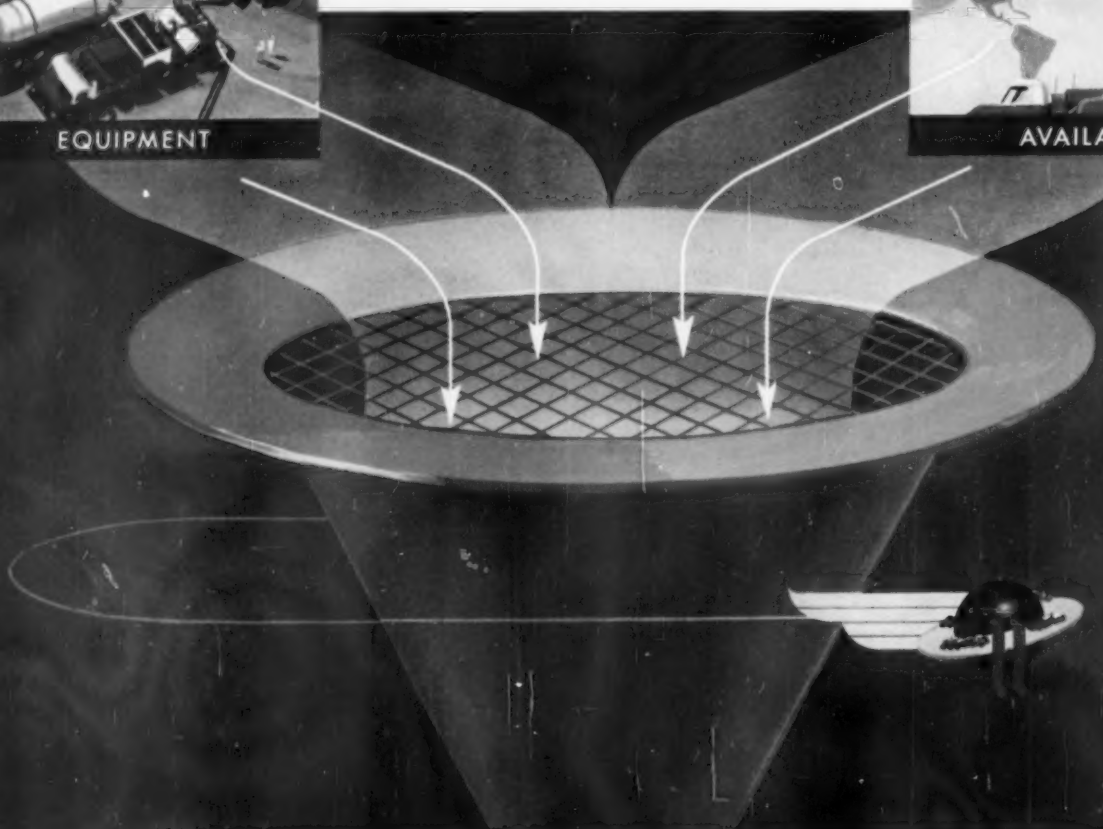

HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Jan. 5, 1959

It's the season for crystal-balling the oil industry:

Most predictions for 1959 out so far sound optimistic. And there's sound reason for this. The industry ended December and started off the new year with very high demand and stocks whittled down to respectable levels (p. 67).

Economists interpret this demand-stock position as the prelude to an increase in production and firming of crude and product prices in 1959.

This would provide the cash flow for more exploration and drilling work and other capital spending.

Bureau of Mines' forecast calls for:

...Domestic demand up 4.3% to 9,378,000 bbl. daily.

...Total demand up 4% to 9,646,000 bbl. daily.

...Domestic crude production up 8.6% to 7,280,000 bbl. daily. It was 6.5% under 1957 levels during 1958.

...Domestic gasoline demand up 2.8% compared with an increase of only 1.7% in 1958.

...Product imports off 13.3% to 608,000 bbl. daily.

...Crude imports about the same at 950,000 bbl. daily.

Jersey Standard's Holman also is more optimistic this year than last. He expects:

...5% increase in domestic demand.

...8% increase in free-world demand.

...More than 4% increase in Jersey's own world-wide demand for major oil products.

Jersey plans to spend about $1 billion in 1959 for capital expenditures for producing, refining, marketing, tankers, and pipelines.

A big problem for the industry, according to the Jersey chairman, is threat of increased taxes.

▼ ▼ ▼

Odds grow that Chrysler, Ford, and General Motors will be in the field with an economy car by this time next year.

Present small cars are gradually taking too big a slice of the passenger car market to be ignored much longer. The 1959 sales showing will determine the Big 3's final decision (p. 74).

For oil, the small cars are too small a percentage of

vehicles on the road to make significant marketing changes. In fact they may be adding some to gasoline consumption.

Ford Economist George P. Hitchings expects a good year for Detroit. He predicts sales of 6 million cars, including the imports.

▼ ▼ ▼

Depletion allowance may face its gravest peril in session of Congress starting this week.

Turnover in the Senate is reason for the big danger. That body no longer can be counted on to stem the rising tide against depletion in the House (p. 71).

Analysis of senatorial records shows they're not enough sure votes in the new Senate to save present depletion rate. Key to the issue is held by 18 senators, many of them newly elected, whose views are still not known.

▼ ▼ ▼

The gas industry enjoyed a record year in 1958.

It showed a 4.1% gain in customers, a 3% increase in volume of sales, and a 11.3% jump in revenues.

Companies are betting on just as good a showing for 1959. Plans call for spending $1.7 to $1.8 billion, about same as last year, for expansion and development (p. 81).

Automatic-welding equipment for double jointing pipe in field-yard operations is coming on fast (p. 70).

Bechtel has perfected equipment which already is in use on an 80-mile, 24-in. line in Louisiana. H. C. Price only last month also announced it had tested newly designed equipment intended for use on the pipeline right-of-way.

Hearing for new trial of Kansas Hugoton gas-allowable orders has been set for January 12. District judge at Garden City will hear motion from royalty owners.

Royalty owners and the Kansas Corporation Commission expect the case ultimately to go to the state supreme court. The commission is trying to boost the take from Kansas portion of Hugoton field by increasing allowables. Pipelines are opposing the higher allowables, claiming they exceed the market.

Real beef of Kansas producers: Their wells are being used as storage reservoirs while Oklahoma and Texas Hugoton producers are selling nearly twice as much gas. Result is very low income from Kansas wells compared with similar wells in other states.

▼ ▼ ▼

An idle tender is being converted into a floating drilling barge by Zapata. It will make its debut soon in offshore work in the Gulf of Mexico (p. 69).

It's an effort by Zapata to combat the offshore slump and find jobs for idle equipment. Offshore activity has been at only 35% of capacity in 1958 but less than 25% of the available platform tenders have found work. Those tenders which worked were used by their owners.

A 2-year drilling contract in Persian Gulf will bring International Drilling Co. of The Hague $9,500 each work day from the Japanese-owned Arabian Oil Co.

Deal runs counter to most offshore contracts in U. S. Gulf where more and more deals are based on footage.

Other foreign notes: Egypt has awarded more concessions in Sinai Peninsula to Cie. Orientale des Petroles d'Egypte... Basrah Petroleum has given up its offshore rights in Iraq's Persian Gulf territorial waters under government pressure... Sir Philip Southwell will step down in midyear as managing director of Kuwait Oil. Replacement will be William Fraser, only son of Lord Strathalmond, long-time BP head...Pan Land Oil of Dallas has obtained a million-acre concession in Turkey.

▼ ▼ ▼

For refiners thinking of new downstream processing units, this is a good time to let contracts.

Two reasons for this:

...Pressure for higher octanes may resume this year after a moratorium during 1958.

...Most contractors are now "available" for new jobs and refiners may never again match the service and cost advantages they'll realize right now.

Ashland is reopening its Louisville refinery.

Plant will process excess supplies of crude oil from the recently discovered Green County, Kentucky, field. Ashland also has a new crude line planned from Green County into Louisville. By processing the crude at Louisville, cost of barging the oil on to Catlettsburg is eliminated.

Ashland also plans to add an aliphatics-solvent plant and expand gas-recovery system at Catlettsburg. Work will start January 15 with completion set for early summer. New units will enable the refinery to produce specialty jet fuels, increase high-octane component production and lift LPG recovery.

▼ ▼ ▼

Plenty will be at stake when "Methane Pioneer" sails from Louisiana this month on an historic voyage of our times.

World-wide interest is keen about the trip. The converted freighter will carry 33,000 bbl. of liquefied methane. If successful, the voyage could launch a new industry and open

an abundant supply of cheaper energy for have-not nations.

Unofficial estimates show the gas can be purchased in South Louisiana, liquefied, loaded into a special ship, and discharged in England for 35 to 50 cents per M.c.f. This compares with $1.61 per M.c.f. for manufactured gas at the same point.

Series of other studies give similar competitive prices on liquefied gas moved by tanker from Venezuela, the Sahara, and the Middle East to Europe and even to Northeastern U. S. (p. 76).

The voyage will be first of several to prove the technology and economics of moving liquefied gas overseas. There's little doubt it will succeed. One of project's backers reportedly is negotiating in New York for a $25-million liquefaction plant in Venezuela.

▼ ▼ ▼

American Petrofina has two deals cooking, according to financial circles, which could give it a boost toward avowed goal of becoming a major U. S. oil firm.

Petrofina reportedly has nearly completed deal to acquire large Middle Western oil company which has three refineries with total capacity of 65,000 bbl. daily and more than 800 filling stations.

Aurora Gasoline Co., Detroit, is the only company fitting this description. Officials of both Aurora and Petrofina declined to confirm or deny they are negctiating.

The purchase would more than double Petrofina's refining capacity and raise its station outlets more than 60%.

More important deal is a reciprocal crude-oil arrangement now being negotiated by Belgian Petrofina, parent of the U. S. firm.

Belgian Petrofina would purchase Middle East crude from a major U. S. international oil company for use in its European refineries. In turn, American Petrofina would be allowed to buy domestic crude from the international company at a 40-50-cent per barrel reduction.

This would give American Petrofina a cost reduction of about 1-cent per gallon on gasoline. Its effect on company's earnings would be spectacular.

▼ ▼ ▼

Pressure to impose mandatory controls over imports likely will increase in wake of Carson's latest report.

New statistics show November imports of both crude and products exceeded their quotas.

Crude imports rose to 975,900 bbl. daily, a gain of more than 50,000 bbl. daily over October and 41,000 bbl. daily over quotas.

Unfinished products imports reached 196,200 bbl. daily. This is 16,800 bbl. daily above the May-June average.

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The OIL AND GAS JOURNAL

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211 South Cheyenne Ave.
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NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-6160

Paul Swain ..... International Editor
Larry Resen ..... Refining Editor
Ray G. Gibson ..... District Editor
John P. O'Donnell ..... District Editor

HOUSTON OFFICE
802 American Investors Building
Phone CApitol 4-7726

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DALLAS OFFICE
1238 Mercantile Bldg.
Phone Riverside 8-3074

Robert J. Enright ..... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone MAdison 2-0722

D. H. Stormont ..... West Coast Editor
William T. Smith ..... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Joe Reilly ..... Washington Editor

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TECHNOLOGY—OPERATION

Refining-Processing

New Units Insure Octane Flexibility for D-X Sunray 92

By Joe H. Miller

This company can now produce premium gasoline of 100 octane or better at its Tulsa refinery. The original sulfuric acid alkylation unit and the new HF alkylation unit are balanced to make nearly 5,000 bbl. per day of light alkylate. Other new units include a 20,000-bbl. Unifiner, a 12,000-bbl. Platformer, and a 2,400-bbl. butane isomerization unit.

Refinery Construction Index 105

The monthly report of cost indexes for refinery equipment.

Quarterly Costimating Report 108

Itemized cost indexes for supplies and equipment for all categories used in refineries.

Eliminate Moisture Condensation During Wax Molding 113

By S. F. Kandra and W. D. Manz, Jr.

This was done at Magnolia's Beaumont refinery by silicone coating the molding pans, preheating the pans before filling, and by minor equipment changes. Wax cakes can now be demolded at temperatures above the dew point of the surrounding air. This means reduced cooling time, increased conveyor-belt speed, and a 15% increase in production rates.

Drilling-Production

New Charts Determine Separator Capacity . . 97

By Vernon Smith

Tedious calculations of oil and gas separator capacities are eliminated by four new nomographic charts. They are designed for use with cylindrical, monotube, two-phase separators, both vertical and horizontal. The reliability of of these curves has been verified by field tests. Capacities obtained from the charts are conservative for most field conditions.

Does "Overengineering" Threaten Drilling? 102

By J. U. Teague

Some of drilling's most publicized and expensive developments turn out to be fads or unsound schemes. These are a burden to the drilling contractors. Oil-company engineers should eliminate most of these false steps by making sure they are using existing equipment and methods to the fullest before recommending new, untried means. Drilling contractors could prevent much of this by doing more research on drilling methods.

Stop Mud Pump Knocks and Save the Pump 118

By Samuel L. Collier

A new system of instrumentation determines the causes and remedies of valve knocks in oilfield mud pumps. Results of studies of this problem is that fluid knock can now be designed out of the mud system. This is important because it has a big effect on the life of the pump.

Jack Blocks Up Spool of Wire Rope 132

Pipelining

Series-Parallel Centrifugal Compressors Provide for Greater Flexibility 123

By Robert E. Schuhmann

The design of the centrifugal compressor on the Trunkline Gas Co. system is unique in that it is basically two compressors in one case, each compressor composed of two impellers, and all on the same shaft. This enables Trunkline to use a gas-turbine prime mover and still obtain operating flexibility.

Interface Detectors: Still Room for Improvement 133

By C. W. Blackburn

Phillips Petroleum Co. uses several makes and several types of interface detectors for various applications, including a wide variety of fluid interfaces in petroleum and chemical installations.

Needed: A Good Batch Interface Detector for Products Pipeline 134

By W. W. Holt, Jr.

Performance requirements of detectors on a products pipeline are most severe.

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NEW

FIGURE
92

The Figure 92 Casing Head is the most recent addition to the Larkin line of Tubing Heads and Casing Heads.

Its Features:

1. 2000 psi working pressure
2. Forged steel body
3. Full opening – to accommodate centralizers or other tools
4. Hinged 3-segment slips (a locking device allows dropping through preventer)
5. Oil resistant Hycar packing
6. Tapered API top thread for direct flanging
7. Economical

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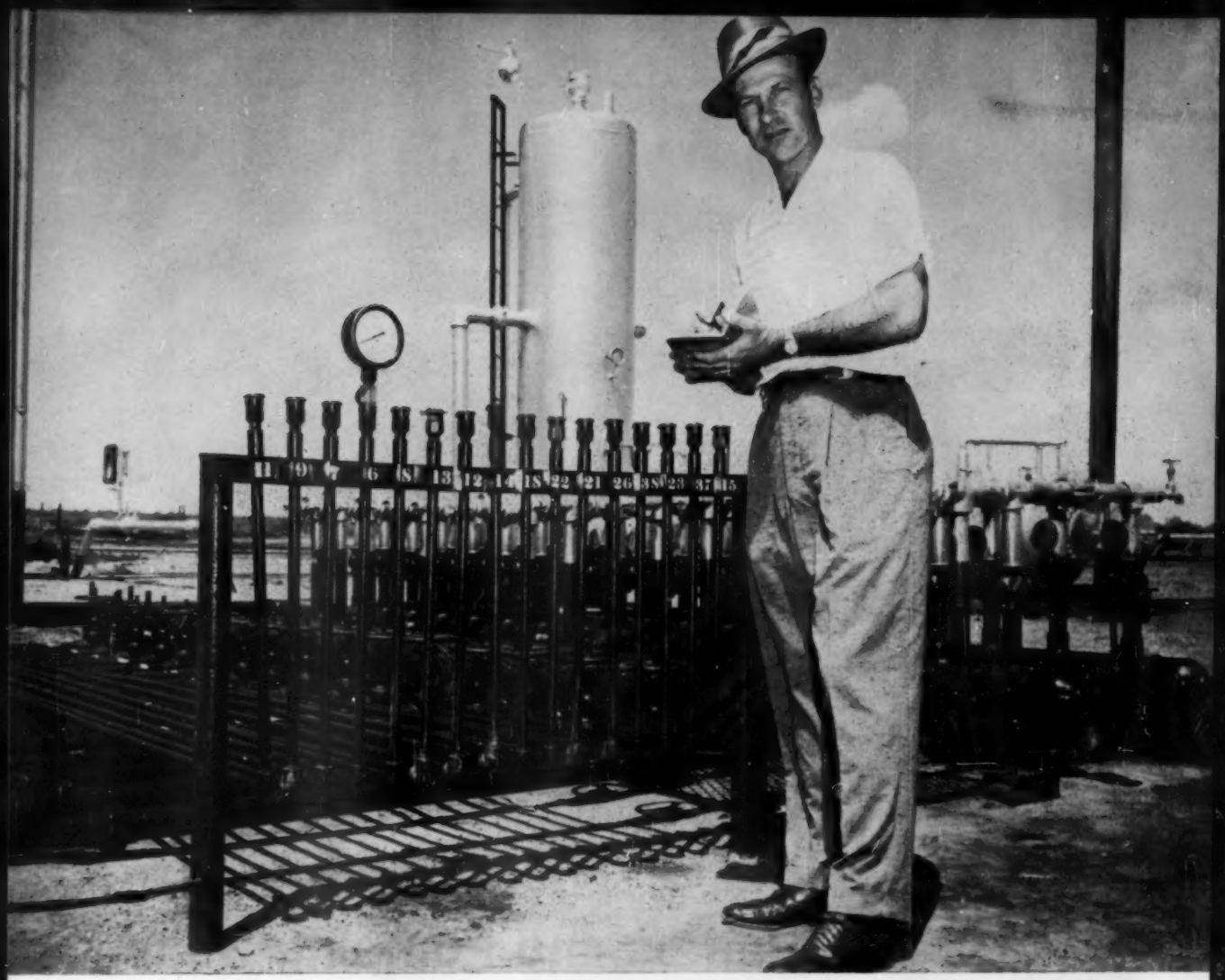
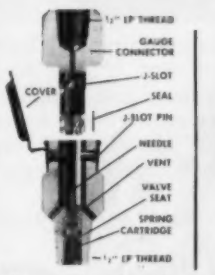


You Can Stand In One Spot And Gauge Sixteen Wells . . . With One Pressure Gauge . . . in 10 minutes!

It's no trick, and you can do it. Pictured above is a 16-well manifold at a central lease tank battery. Instead of separate pressure gauges for each well, the manifold is equipped with T-C Gauge Valves. A single pressure gauge, with a T-C Connector attached, is stabbed into each Gauge Valve to obtain a pressure reading. Just insert the connector in the valve, rotate 45 degrees, the valve opens automatically, and that's all.

For individual wells, instead of installing permanent gauges on tubing and casing, many operators are now using T-C Gauge Valves and Connectors. The first cost is lower, there's no gauge breakage—gauge repair costs are eliminated—and since the gauges are not exposed to the elements, you can be sure of accurate pressure readings.



Cross-section view of Gauge Valve and Connector.

The Gauge Valve and Connector is widely used on Christmas trees.

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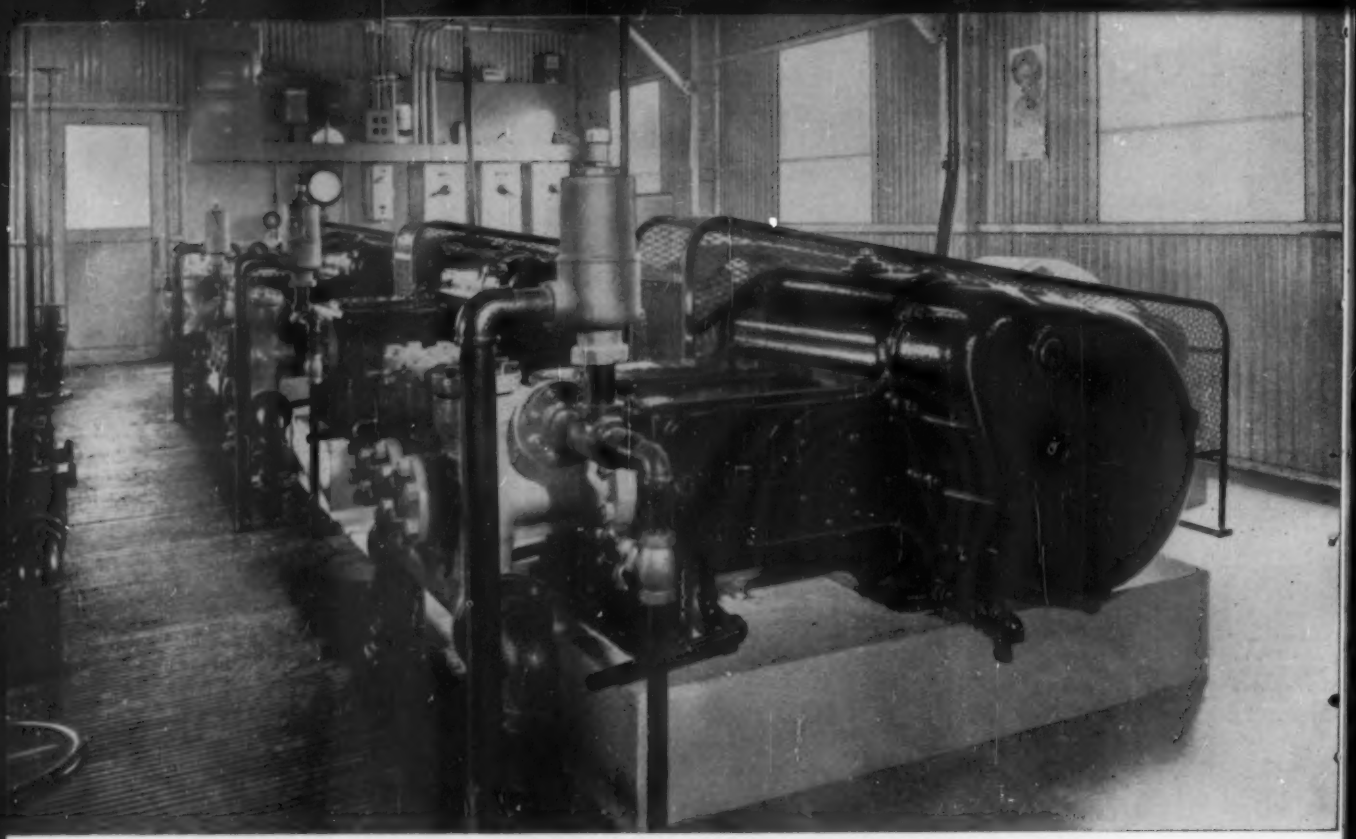

Five "Oilwell" 38-P Triplex Plunger Pumps operate this Lee County, Kentucky, waterflood. A first plant with two pumps was installed some two years ago. The second plant with three pumps (illustrated) was added the following year.

Take the risk out of "put and take" with "Oilwell" Pumps and Pumping Units

AN OIL producer in Kentucky has taken the chance out of these "put and take" operations by installing five "Oilwell" waterflood pumps to **put** water into the wells and 125 "Oilwell" medium-duty pumping units to **take** oil out.

All these units are designed for continuous, rigorous operation with a minimum of attention. Both pumps and pumping units incorporate money- and maintenance-saving features.

An important benefit that this operator will enjoy is dependable service from a single source . . . the local Oil Well Supply Store. Maintenance parts and supplies will always be of the same high quality as originally furnished with this equipment. And "Oilwell" specialists will always be available when needed for consultation on any production problems which may arise.

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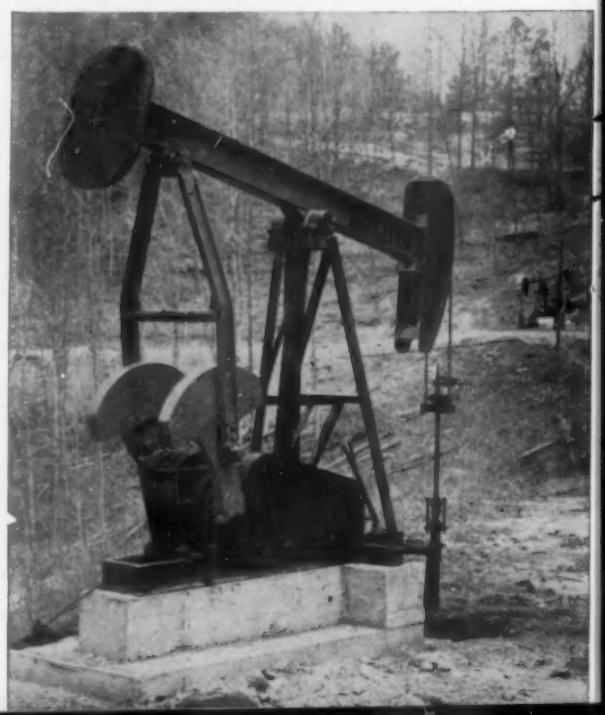
This installation is typical of the electric-powered "Oilwell" 25L3 Pumping Units which are used to take out the oil.



Another new development using

B.F.Goodrich Chemical *raw materials*

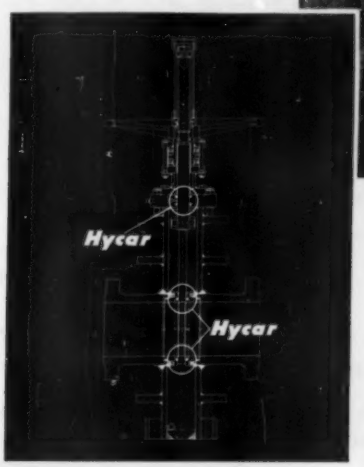
Lubrication-free gate valves use "O" ring seals of *Hycar*

These fabricated steel gate valves prove the extra abrasion resistance and resilience you get from Hycar nitrile rubber in tough oil field operations. Their parallel-sided gates depend on floating metal seats equipped with Hycar "O" rings to provide lubrication-free operation to or from any position with maximum resistance to hydrostatic pressure.

The Hycar "O" rings are in constant contact with both gate faces. They squeegee and polish the faces during valve operation, both to strip foreign material from gate and to assure a bubble-tight seal.

The manufacturer reports, "In thousands of valves in service over many years, Hycar "O" rings have proved their ability to 'take it' under most severe pipeline conditions".

Hycar offers exceptional resistance to change in properties, as well as resistance to abrasion, or corrosion from gas and oil. It will not swell and interfere with valve operation. Hycar is the choice for many tough oil field jobs. Get more information by writing Dept. KC-1, B.F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



Seal-O-Ring gate valves are made by Grove Valve & Regulator Company, Oakland 8, California. Hycar "O" rings are used as packing and at valve seats. B. F. Goodrich Chemical Company supplies the Hycar nitrile rubber only.

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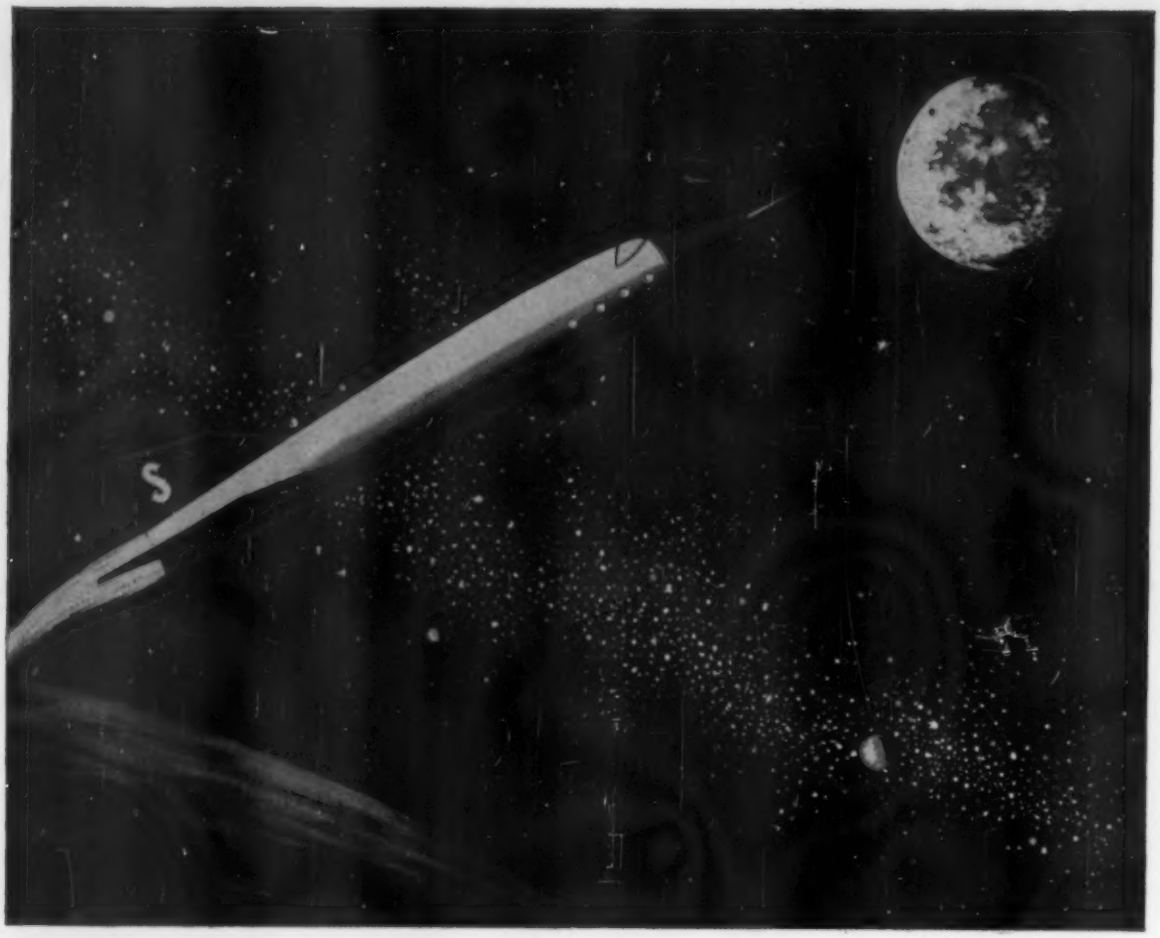

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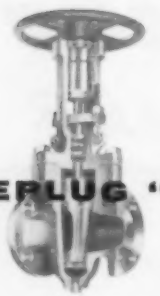

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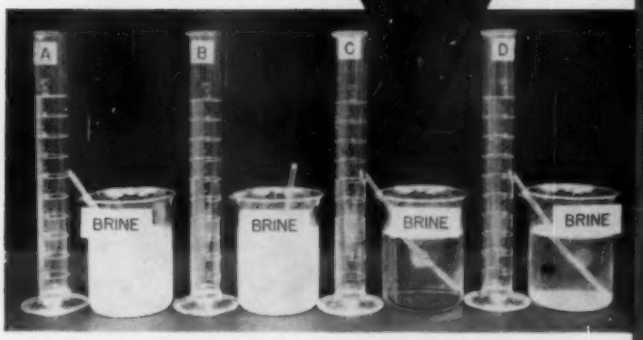
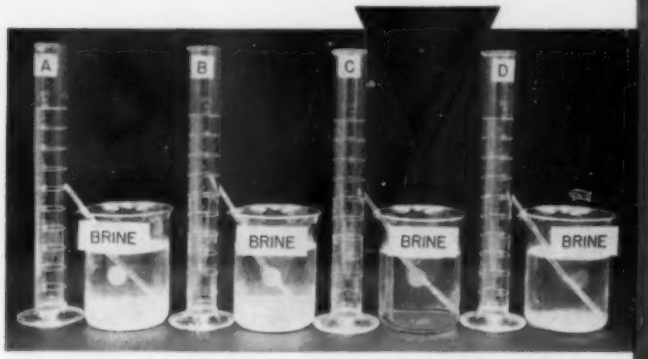


This photograph demonstrates the effectiveness of SCP-2 in eliminating scale and precipitation. Beakers A, B and D contain other anti-scaling agents; Beaker C contains Halliburton's SCP-2.



The same beakers after standing one hour. Note the large amounts of settled precipitate in beakers A, B, and D, and the very small amount of precipitate in beaker C, containing SCP-2.

Spending too much time and money on frequent and expensive scale removal from well bore, formation flow channels and producing equipment?

Here's real help to reduce or eliminate these conditions. Try Halliburton's new outstanding Scale Preventative, SCP-2, with your next fracturing job to help prevent harmful precipitates. You'll get effective and longer lasting protection four important ways:

- The poly-phosphate content, the active ingredient of most anti-scaling compounds, is *appreciably greater in SCP-2 than in other comparable agents.* Thus, the scale inhibiting effect is considerably greater. Formation of precipitate is virtually eliminated.
- SCP-2 is much more stable, both at high and low temperatures.
- SCP-2 is of uniform particle size, giving more uniform solubility.
- SCP-2 is more slowly soluble, giving protection against scaling for the longest possible time.

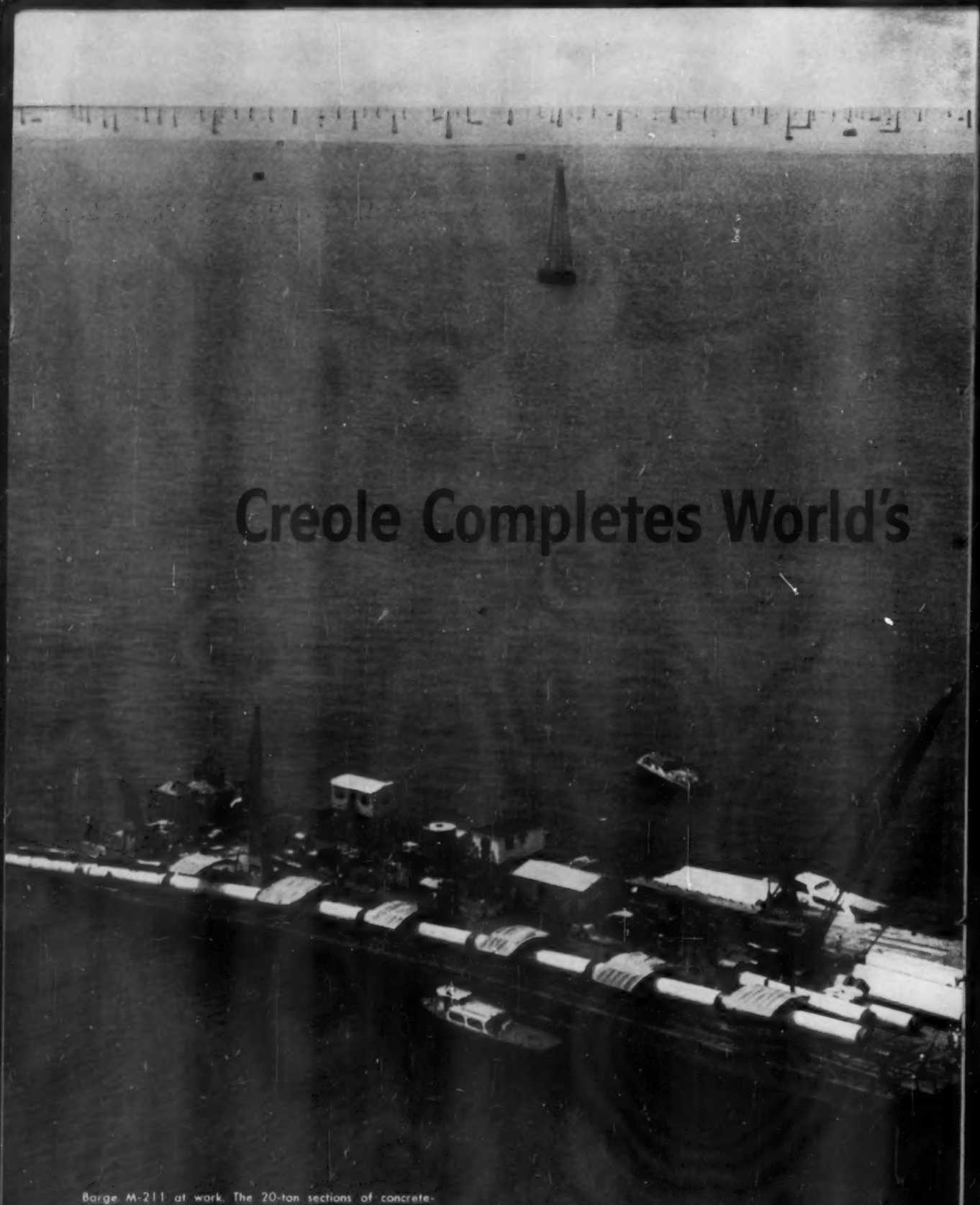
Put the benefits of SCP-2 in your wells.
Call Halliburton . . . today!

HALLIBURTON
FRACTURING SERVICES

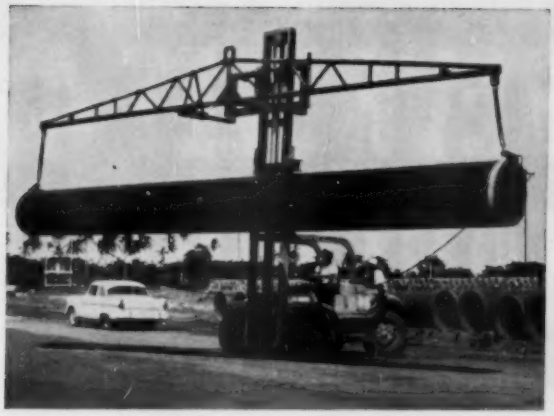
HALLIBURTON OIL WELL CEMENTING COMPANY • DUNCAN, OKLAHOMA

WHERE RESEARCH BRINGS RESULTS IN FORMATION FRACTURING

Creole Completes World's



Barge M-211 at work. The 20-ton sections of concrete-weighted Bethlehem line pipe are welded together and the joints prepared for submersion in Lake Maracaibo.



Mighty Big Pipe. But Bethlehem is prepared to produce even larger line pipe —to 42 in., hydraulically expanded, and in wall thicknesses ¼ to ¾ in. incl.

Bethlehem also produces pipe in smaller diameters, including electric resistance-weld pipe made on our new mill at Sparrows Point, Md.

Largest-Diameter Submarine Gas Line

Lake Maracaibo was the scene of a unique and remarkable pipe-laying project. The contractor for Creole Petroleum Corporation laid approximately 60,000 ft of pipe of record size — 40 in. — in water ranging from 60 to 100 ft in depth. The big pipe is a main gas-gathering line for one of Creole's re-injection systems.

The pipe, made by Bethlehem Steel, was shipped to Venezuela for processing by Brown & Root, Inc., the contractor. In lakeside yards the 40-ft joints were shot-blasted, then weighted with a 6-in. coat of mesh-reinforced concrete. This brought the over-all diameter of each joint to 52 in., and its weight per joint to 20 tons. To lay this heavy pipe, Brown & Root used a barge equipped with five 40-ton-capacity davits, eight 8,000-lb anchors, and a 710-ft lowering pontoon.

What Kind of Pipe Do You Need? Bethlehem can supply hydraulically expanded electric fusion-weld pipe from 18 in. through 42 in. OD, in 40-ft lengths; electric resistance-weld pipe from 5 in. (nom) to 16 in. OD, in lengths to 60 ft; and continuous butt-weld pipe ½ in. to 4 in. (nom) in various lengths. All meet the appropriate API specifications.

Contact the nearest Bethlehem Steel sales office for full information. We'll be glad to help you.

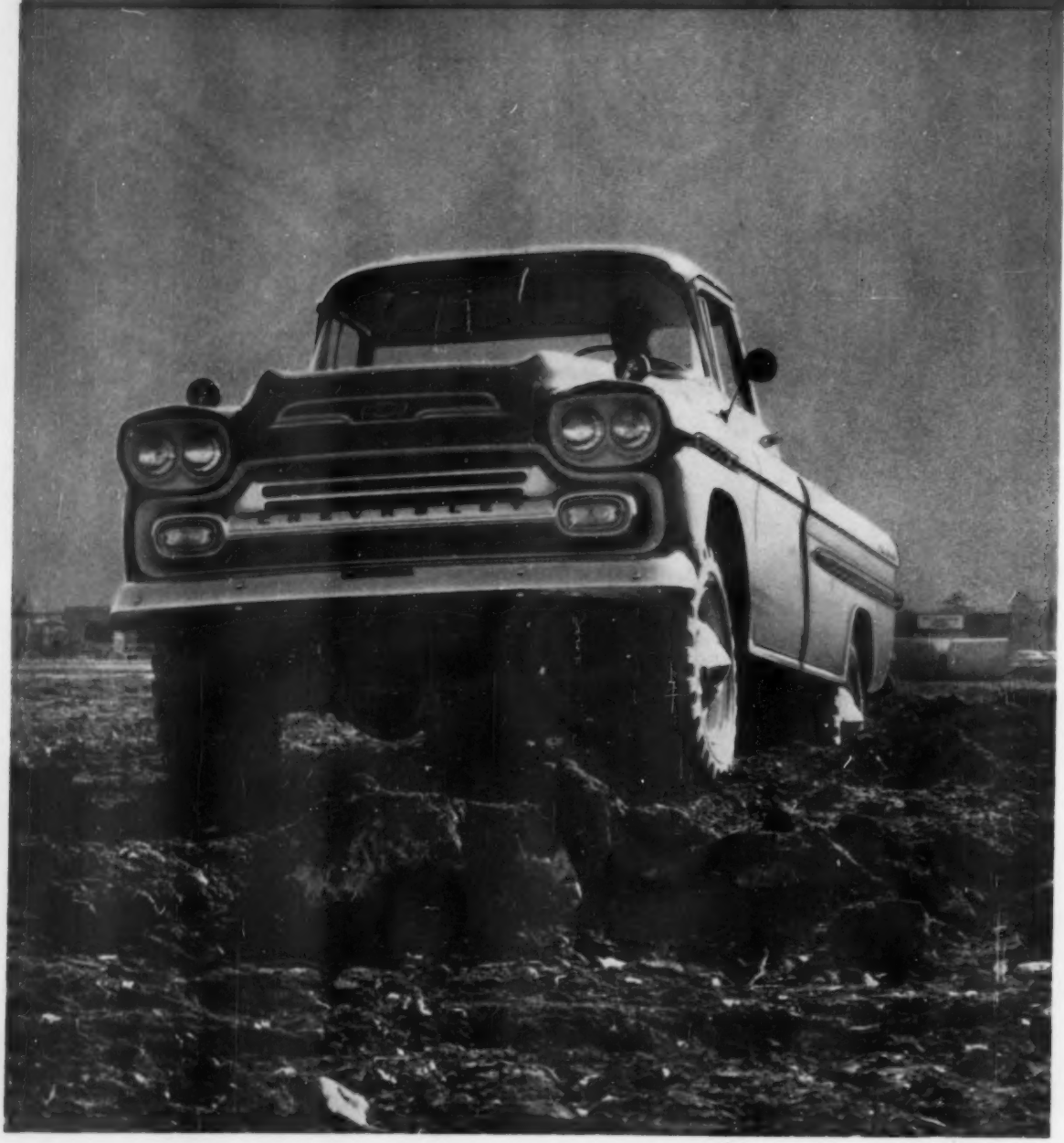
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

NEW CHEVROLET 4-
YOU TO HAUL WHERE



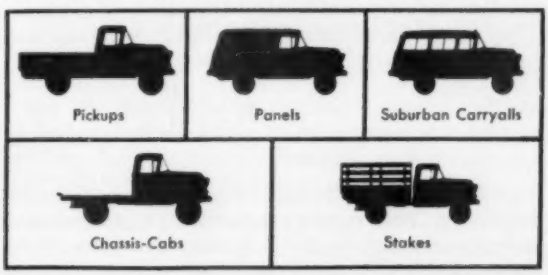
WHEEL DRIVE ENABLES YOU COULDN'T BEFORE!

Chevrolet's new 4-wheel drive really digs in and does it . . . enables you to haul through deep mud, snow, swampy areas and up towering grades. With up to twice the traction, wheels are able to grab hold and go!

An easy shift of a lever . . . and you've got *traction* that bites in and pulls with the tenacity of a light tank!

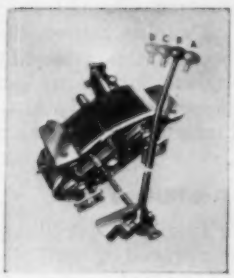
This new Chevy unit is the latest thing in 4-wheel drives. Consisting basically of a rubber-mounted power divider with precision-engineered front axle, it distributes power evenly to front and rear axles. And when the going is extremely difficult, it directs power to whichever axle is getting the best traction. Result: Your load goes through, whether the road does or not!

CHEVROLET 4-WHEEL DRIVE SUITS MANY MODELS



Fourteen tough-built Chevy models whip rough-and-tumble terrain like never before! There are 4-wheel drive *pickups* for ploughing, grading, snow removal jobs, and others . . . *panels* for surveying, delivery, and construction tasks . . . *Suburban Carryalls* for sportsmen and tough cargo-and-passenger-carrying jobs . . . *stakes* for work that calls for heavy back-country hauling . . . and *chassis-cabs* for a broad range of special applications!

EASY SINGLE-STICK CONTROL



One easy motion operates the power divider. Shifting between 2-wheel drive and 4-wheel drive can be done whether the truck is stopped or moving. Lever has these 4 positions:

a. 4-wheel underdrive
b. Neutral
c. 2-wheel direct
d. 4-wheel direct

POWER FOR SPECIAL EQUIPMENT

Four power take-off outlets permit use of a wide variety of special equipment: saws, generators, winches, pneumatic hammers, post-hole diggers, back hoes, and many more! SAE 6-bolt outlet is on transmission; other outlets are on power divider.

Get complete information on new Chevrolet 4-wheel drive!

MAIL THIS COUPON TO COMMERCIAL & TRUCK DEPARTMENT, CHEVROLET DIVISION OF GENERAL MOTORS, DETROIT 2, MICHIGAN

Name _____

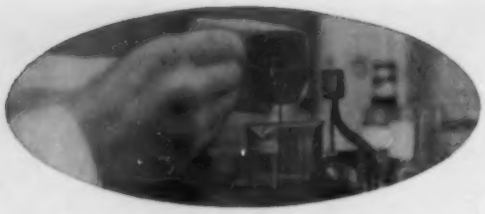
Address _____

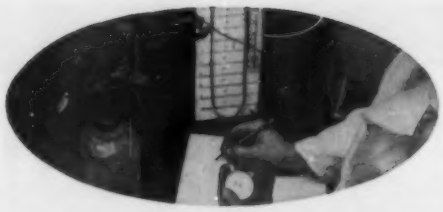
City _____ Zone _____ State _____

(OG-1)

See your nearby Chevrolet dealer about versatile 4-wheel drive in

CHEVROLET TASK·FORCE 59 TRUCKS





A look at today...and a glimpse

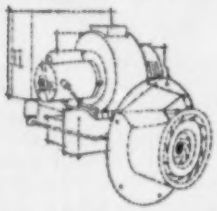
Armour Chemicals for Refined Products

Where they work today

Fuel oils—gasolines—asphalts. Every major area in refining can profit from Armour Chemicals. There is a variety of economical, oil soluble, cationic chemicals for each special job. Some function as additives for direct use in finished products; others are ideal as corrosion inhibitors during processing; still others perform as versatile chemical intermediates in the making of new products.

Fuel Oil Additives

The Armolads® are Armour's series of special furnace oil additives. They have been proved efficient at costs of less than 1¢/bbl.—making them the most economical fuel oil additives now being offered refineries.



All the Armolads are ashless additives. They are of the inhibitor-dispersant type and will impart corrosion inhibiting properties.

Armolads are fatty amine derivatives and are 100% active. It has been proven that the Armolads will effectively stabilize oil against insoluble gum formation and color degradation, and improve filterability without promoting emulsions in furnace oils from various crude sources.

Physical characteristics

	Pour Point	Specific Gravity
Armolad F22	28°F	0.857 at 79°F
Armolad F24	64°F	0.856 at 79°F
Armolad F25	62°F	0.835 at 84°F
Armolad F26	38°F	0.822 at 79°F
Armolad F28	52°F	0.840 at 79°F
Armolad F20	Melt Pt (approx) 115°F	0.797 at 138°F

Comparison tests (Mid-East stock)

	12 months ambient storage Mg/liter	DuPont's 13 week test Mg/liter	UltraViolet light test Mg/liter
Control	134	36.0	64.5
Armolad F22	68	4.0	20.5
Armolad F20	74	4.0	23.5
Competitor M	139	102.5	23.5

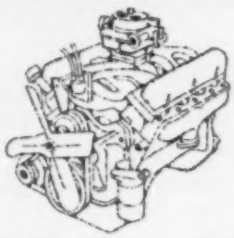
All crude stocks—Mid-Continent, Mid-East, West Texas, and Venezuelan—can be improved by one of the Armolads.

Armour will recommend a specific Armolad for the crude oil you're processing and help you determine the optimum concentration needed to do a satisfactory job economically.

For more information on the entire series of Armolads, check "A" in the coupon.

Gasolines

Armour Chemical offers refiners several chemicals that have found wide acceptance as gasoline additives. Both the Armeens® and Duomeens® are used as anti-stalling additives.



The Armeens . . . $R(NH_2)$—are high molecular weight aliphatic amines. They are cationic surface active agents and have the ability to change surfaces from hydrophilic to hydrophobic.

The Duomeens . . . $R(NH)CH_2CH_2CH_2(NH_2)$ . . . are Armour's series of N-alkyl trimethylene diamines. They are prepared according to the following reaction:

$$RNH_2 + CH_2{=}CH_2\ C{\equiv}N \xrightarrow{H_2} RNHCH_2CH_2CH_2NH_2$$

The Armeens and Duomeens are excellent corrosion inhibitors. Both can be reacted with various organic or inorganic acids to give you additional versatile additives which will impart the following characteristics: (1) excellent detergency, (2) improved thermal stability, (3) increased lubricity.

For more information on the Armeens and Duomeens as they are applied in refinery applications, check "B" in the coupon.

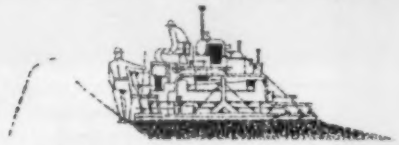
Asphalts

If you have an additive requirement when marketing asphalt, it will profit you to know more about the Redicotes® and Duomeen T. Armour's chemicals for this area of refining are designed to help you make treated asphalt that will pass difficult state stripping tests. They're effective at concentrations as low as 0.2%. Even at such a low concentration they im-

# of tomorrow

from Armour Chemical

prove adhesion of asphalt to damp or wet aggregates, permitting contractors and highway departments—your customers—to extend their paving season.



Many asphalt plants and refineries are using Duomeen T or Ethoduomeen T/13 as a starting material for making their own asphalt adhesion agents. Let Armour's technical staff assist you in formulating your own anti-stripping additive.

Chemical-physical properties of Redicotes

(Salts of Polyamines derived from tallow)

Redicote	Pour Point	Typical Viscosity in Centipoises	Typical Specific Gravity	Per Cent Active
75	90°F	1750 @ 30°C	0.897 @ 50°C	100%
2793	50°F	35(SSF) @ 50°C	0.917 @ 50°C	60%
2323	40°F	60(SSF) @ 50°C	0.952 @ 25°C	60%
2370	50°F	80(SSF) @ 50°C	0.930 @ 38°C	100%

For additional data, check "C" in the coupon.

Where Armour Chemicals for refineries will work tomorrow

In fuel oils. More efficient dispersants and stabilizers for the heavier fuel oils are being developed by Armour for the refining industry. Results have been encouraging and will be announced in the near future.

In gasolines. Armour is currently developing new poly-functional materials to make gasoline engines run cleaner. Work is progressing with additives to improve engine performance all year-round.

In emulsion-grade asphalts. Armour will have information available on cationic emulsifiers that are insensitive to hard water; that promote better adhesion on all types of aggregate; and that can be used at economical concentrations with asphalt from any crude source. Other new outlets are also being studied in asphalt-based paints, roofing, caulking compounds, adhesives, mastics and insulations.

Find out how Armour's chemicals for refineries can work for you. Our chemical specialists will help you utilize the right additive or basic chemical for your products or special situation. Write or call Armour today.

NEWS NOTES

London, England. A new, improved corrosion inhibitor has been developed for application in both refinery streams and in metal working oils. The inhibitor is formed by reacting an Armour diamine with wool grease olein.

•

Hamburg, Germany. Difficult performance specifications now required by a growing economy have been met by incorporating an Armour amine into crankcase lubricants and an Armour diamine into diesel oils.

•

Cleveland. Increased die life, cleaner surfaces, the elimination of breaks, and the stopping of chattering is being accomplished by oil soluble diamine salts at one of the large tube manufacturers in this area.

•

Wilmington, South Carolina. Within the past month, new asphalt test roads have been laid here from finely dispersed, stable cationic emulsions. The emulsions were prepared with Armour's cationic surfactants.

•

San Francisco. Drum corrosion is being effectively combatted by an Armour diamine at concentrations of ½ to 1% in a product consisting of phenolic and chlorinated chemical dissolved in kerosene.

How can Armour Chemicals help you?

Check here for more information on your field of interest. ☐ A ☐ B ☐ C

OGJ-1-59

Send sample and more information for this application:

_____

_____

_____

NAME _____

POSITION _____

COMPANY _____

ADDRESS _____

CITY _____ STATE _____

Leader In Progressive Fatty Acid Chemistry

ARMOUR CHEMICAL DIVISION

1355 West 31st Street · Chicago 9, Illinois

© Armour and Company

JUST A PILE OF DIRT . . . but it's the beginning of even BETTER SERVICE for you from 12 STRATEGIC LOCATIONS

That pile of dirt is the first truckload hauled in for the new addition to our plant in Houston. When completed, these expanded facilities will provide even larger field stocks at the locations shown above and will permit even faster delivery of emergency orders from Houston.

For you, this means that practically all of your normal requirements of Yale Machine Works unions can be supplied from our field warehouses in event supply store stocks are depleted. Special orders can be furnished from Houston in time to meet your needs.

This improved service is our way of saying "Thanks" for your acceptance of our products. Use these facilities for convenience and expediency by specifying "Yale Machine Works" whenever you need unions.

REPRESENTATIVES

Slim LaGrone Co. — Odessa, Texas
Bob Hawk Eqpt. Co. — Hobbs, N.M.
Broiles & Cope — Wichita Falls, Texas
A. S. (Andy) Herron — Lake Charles, La.
C. B. Blair — Shreveport, Louisiana
Louis Ray — Farmington, N.M.
Rocky Mtn. Spec. Co. — Casper, Wyo.
Howard Crider — Oklahoma City, Okla.
L. P. Kinnear — Great Bend, Kansas
Lee Snodgrass Co. — Southgate, Cal.
Neil Ginther — Wooster, Ohio
Thornton C. Hughes — Edmonton, Canada
R. S. Stokvis & Sons, Inc. — New York

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YALE MACHINE WORKS
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DISTRIBUTED BY
YALE SALES COMPANY
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Instrument Monitors Corrosion Rates While Equipment Stays on Line

Fastest Known Corrosion Rate Measurement

The *Corrosometer* is its name. It proves the effectiveness of Nalco refinery stream corrosion inhibitors . . . in a hurry. It is the fastest known method of determining corrosion rates in operating equipment; manufactured by Crest Instrument Co. under license from Standard Oil Company (Indiana), and distributed worldwide, by Nalco.

Corrosometer readings are taken quickly and accurately, indoors or out. Instrument leads are attached to probes mounted in corrosion trouble spots. One instrument serves virtually any number of probes.

Coupons, Inspections are Slower

Determining corrosion rates by loss-in-weight methods, using coupons inserted in lines, is a much slower process. Valuable in determining average corrosion rates, it lacks the speed that enables the Corrosometer to reveal immediately any change in corrosion rate caused by process variations. Nalco Representatives, as well as Nalco Corrosion Inhibitor customers and prospects, welcome the speed with which the Corrosometer delivers accurate corrosion rate readings as a real contribution to time and money-saving establishment of good corrosion control practices.

Corrosometer Can Show Day-to-Day Corrosion Rates in System

Readings taken with the Corrosometer show the corrosion rate in the system for a predetermined interval of time. The interval may be as long as desired—or as short as a day or less. Thus checks of Nalco treatment effectiveness, as well as prompt detection of unexpected increases in corrosivity, are practical and accurate with the Corrosometer.

How Corrosometer Works . . .

Utilizing the Kelvin electrical bridge circuit, the Corrosometer compares resistances of two similar probes: one protected from corrosion, the other directly in contact with the liquid or gas in the equipment under test. Corrosion of the unprotected probe increases its electrical resistance, and the difference between probe resistances is directly convertible to corrosion-rate readings of high accuracy.

Retractable probes, for easy replacement without shutting down the system, and probes for high temperature and high pressure systems make the Corrosometer a valuable tool in checking Nalco Results in all types of corrosion-prone equipment.

Your Nalco Representative can give you full details on both the Corrosometer and Nalco corrosion inhibitors. Call him today — or write for descriptive literature.

Refinery Corrosion Probe

Retractable probe can be installed through a gate valve; replaced quickly without taking equipment off line.

NATIONAL ALUMINATE CORPORATION

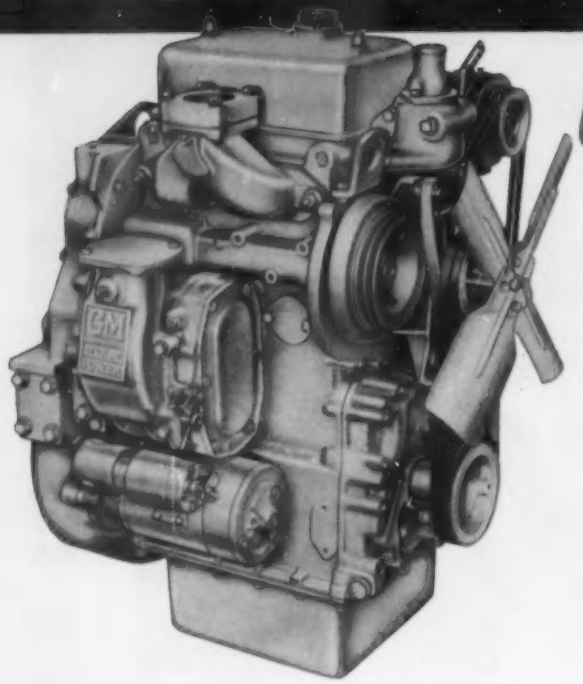
6242 W. 66th Place • Chicago 38, Illinois

Branches and affiliates in Canada, Germany, Italy and Spain.

Nalco® ***Serving Industry through Practical Applied Science***

Nalco CHEMICALS

MORE BIG NEWS FROM



Now a *DIESEL* Engine for JOHN DEERE 440 TRACTORS

Bringing you every DIESEL advantage PLUS 10% MORE POWER

Here, power-matched to John Deere "440" Crawlers and Wheel Tractors, is a modern Diesel power plant that means even greater savings for you on time and fuel. Equipped with this famous "Jimmy" Diesel engine, John Deere "440" Tractors not only provide *more* power—10 per cent more than previous tractors in the line—they also give you the *faster* response of high-compression, high-torque Diesel performance.

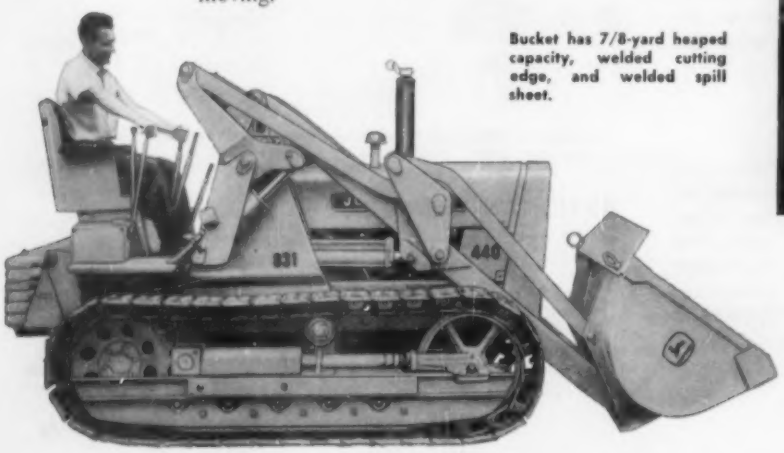
In addition, the "fire insurance" of Diesel fuel opens up new construction and materials-handling jobs to the John Deere "440" in mines, dockyards, and other confined areas.

Whatever your reasons for preferring Diesel power, act now—cash in on modern Diesel advantages with a John Deere "440" Crawler or Wheel Tractor and matched working equipment.

A *New* answer to speedy, low-cost loading... THE JOHN DEERE 831 LOADER

Take your choice of John Deere gasoline or Diesel power, but pick the new John Deere 831 Loader for a *new low* in earth-moving costs! Rugged construction, plus the husky hydraulic system of the "440," provides extra pry-out pressure and lifting ability that greatly increase daily work capacity.

Check into the new John Deere 831 Crawler-Loader now—start setting new records for low-cost earth moving.



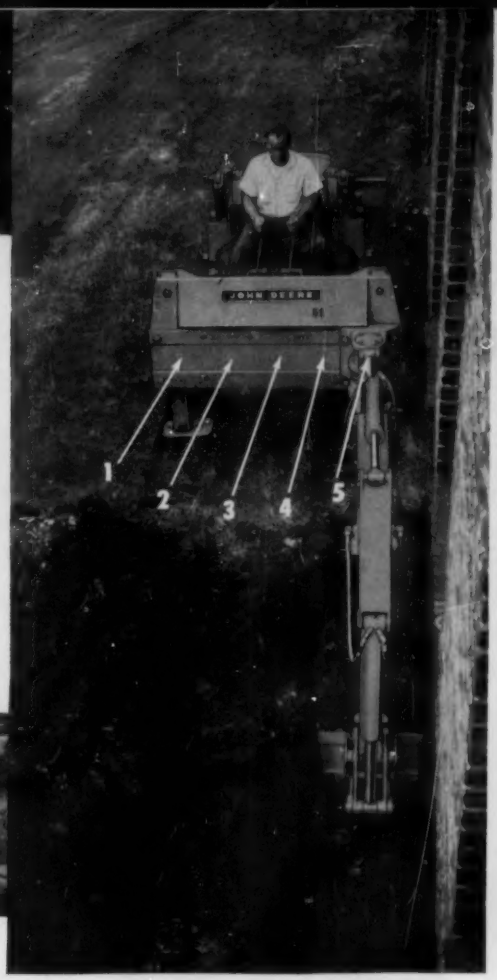
Bucket has 7/8-yard heaped capacity, welded cutting edge, and welded spill sheet.

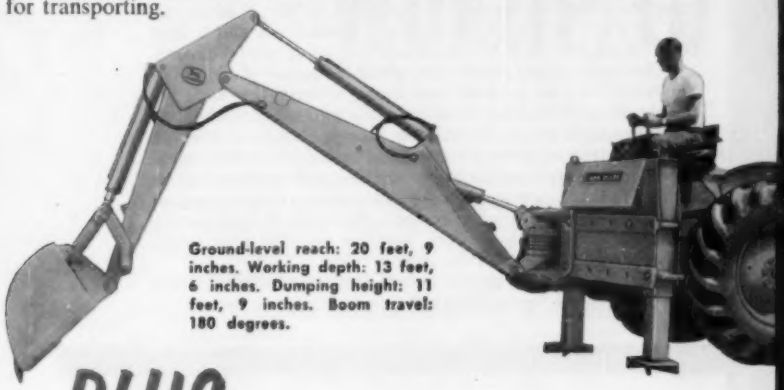
When bucket is dumped from full-height position, it returns to the ideal 9-degree digging angle by use of the boom control only.

JOHN DEERE

Introducing the FIRST 5-POSITION BACKHOE in the Field... THE *New* JOHN DEERE No. 51

One man with a wrench can set the boom on this John Deere 51 Backhoe in any of five mounting positions—in 15 minutes or less. End position at right or left speeds flush-digging along buildings. End mounted, the hoe folds against tractor to make a compact, well-balanced unit for transporting.





Ground-level reach: 20 feet, 9 inches. Working depth: 13 feet, 6 inches. Dumping height: 11 feet, 9 inches. Boom travel: 180 degrees.

PLUS

...a brand *New* center-position BACKHOE... THE JOHN DEERE No. 50

Working depth of the John Deere 50 Backhoe is 13 feet, 6 inches. Bucket has side-cutting edges and replaceable teeth.

Here's reach and power to tackle any trenching job! Center-mounted boom has a 20-foot, 3-inch reach at ground level, swings smoothly through a 205-degree arc by hydraulic power. Two control levers do the job, while operator sits in comfort. Same hydraulic system that operates backhoe also powers loader.

JOHN DEERE Industrial Tractors and Equipment

Completely Engineered for Industry

SEND FOR FREE LITERATURE

JOHN DEERE INDUSTRIAL DIVISION

• Moline, Ill. • Dept. D-46-H

Please send free information on ☐ "440" Diesel Crawlers ☐ "440" Diesel Wheel Tractors ☐ 831 Loader ☐ 50 Backhoe ☐ 51 Backhoe.

*Name*_____

*Firm*_____

*Address*_____

*City*_____

*State*_____

Servco Pilot Mills chew up 1138′ of 9-5/8″, 53-50 casing at an average milling rate of

4′ per hour!

Servco Pilot Mills were put to work milling stuck casing after cut-and-pull operations had been tried with poor results. The complete milling job involved 907′ of 9⅝″, 53-50#, N-80 casing, 231′ of 9⅝″, 53-50#, P-110 casing, 7 centralizers and 1 float collar. In all, more than 61,000 pounds of shavings were produced.

These astonishing results were possible because of the use of Servcoloy*—a new, patented hard-facing material that has completely changed thinking about downhole milling. Servcoloy suspends hundreds of carbide chunks in a tough, elastic matrix which acts as a shock absorber—overcoming carbide's inherent sensitivity to shock and permitting its superior cutting quality to be utilized fully. As cutting edges are dulled or torn from the matrix, new edges are automatically exposed. Hundreds of fresh cutting edges are continuously at work, enabling remedial work which formerly took days to do to be done in hours.

Why not put these proven tools to work on your next milling job? Your nearest Servco office will give you complete details.

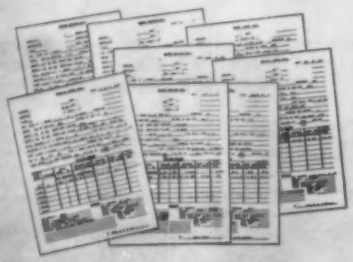
*PATENT NO. 2,833,638

CAN YOUR PRESENT MILLING METHOD MATCH THESE SERVCOLOY RESULTS?

Csg. Wt. & Grade	Total Footage Milled	Milling Hrs.	Time Min.	Ave. Footage Milled Per Hr.	No. Mills Req'd.	Depths
7⅝" 33.70# N-80	110.5*	53	05	2.1	4	Below 12,500′
7⅝" 29.70# N-80	103**	28	07	3.6	2	Below 13,000′
7" 26# N-80	82	14	40	5.8	2	Below 10,000′
7" 26# N-80	202***	18	48	10.6	2	Below 14,000′

*Includes milling bottom half of safety joint and cross over bushing.
**22° angle directional hole.
***Includes milling rotary shoe.

Actual job records and other information will be sent upon request.



SERVCO

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Mid-Continent and Gulf Coast: 4850 Gasmer St., Houston 35, Texas
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How much is EFFICIENT mud de-sanding worth to you?

Comparative tests have shown actual savings of nearly 6000 Dollars per well when Dorrco D-Sanders were used in drilling South Louisiana wells. With results like that, the cost of the D-Sander was paid off fast and overall well costs were substantially reduced.

Many users of other designs, some shop-fabricated and some purchased, have found that mere treatment of mud with a cyclone action is not sufficient to obtain the results reported above.

What was the difference?

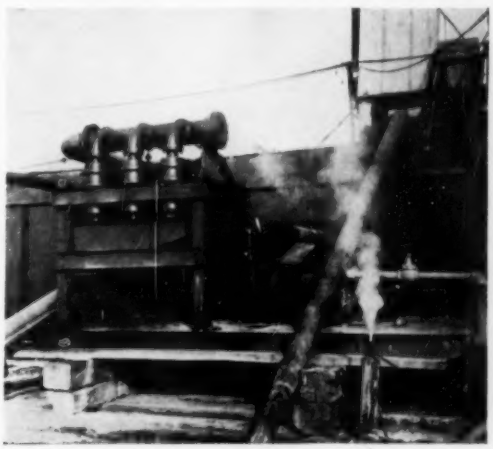
The main difference was the de-sander actually used. The comparative tests mentioned here were conducted using a high-capacity Dorrco D-Sander that had been engineered by Salt Water Control, Incorporated, of Fort Worth.

This unit removes virtually all the sand and much of the finer drilled solids from 600 to 800 gallons of mud per minute. By actual measurement, a Dorrco D-Sander has removed over 1500 barrels of sand and clay from the mud while drilling a single well to 9200 feet, thereby keeping sand content less than one-half per cent and solids low.

An important advantage of the Dorrco cyclone is its "balanced" design. Since there is no underflow unless undesired solids are present in the mud, waste of water, oil, and expensive drilling chemicals are held to a minimum. It is practical to operate the Dorrco D-Sander continuously and avoid expensive intermittent increases in sand content.

D-Sanders are engineered for long trouble-free service. Some units have been in service for over two years without major repairs. All parts have been engineered to withstand abrasion from high velocity sand. The entire unit is ruggedly built to take repeated moves without damage.

Whatever benefits you want from de-sanding (faster drilling, more footage per bit, less wear on mud pump parts, easier running of casing) you will get them in full measure with a Dorrco D-Sander. Be safe instead of sorry! Be sure to ask your SWACO representative for full information before you buy *any* de-sander. You will be glad you did.



SWACO

SALT WATER CONTROL Inc.

1809 Continental National Bank Bldg. Phone: ED 2-4434 Ft. Worth 2, Texas

It's New ...another first from REED !

FLUSH-FLO

THE MOST IMPORTANT ADVANCEMENT IN MODERN BIT DESIGN...

The Reed Jet Y Bit With Flush-Flo Design Is The Only Rock Bit That Gives You All These Advantages—

1. *50% more return circulation area. Faster removal of cuttings.*
2. *Minimizes hole erosion.*
3. *Automatic self-cleaning in bit head and over teeth.*
4. *Reduced bottom hole pressure. More effective jets.*
5. *Improved hydraulics.*
6. *50% less swabbing action when pulling string.*
7. *Cutter teeth are drilling on new formation (not old cuttings) at all times.*

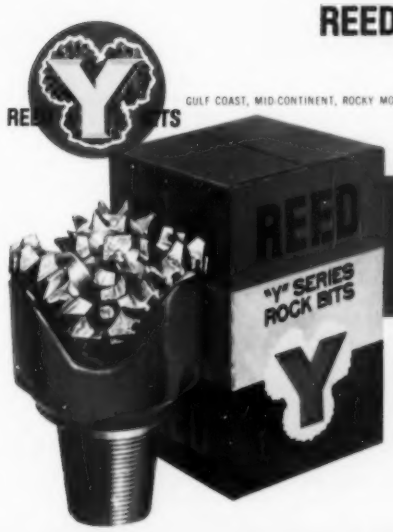
Contact the Reed man that services your well for the full story on Reed Jet Y bits. He can also help you with your everyday problems where you use conventional pump pressures and mud volumes. The regular Reed Y bit and the Reed Jet Y bit will get you down hole faster in any formation.

REED ROLLER BIT COMPANY

Houston 1, Texas

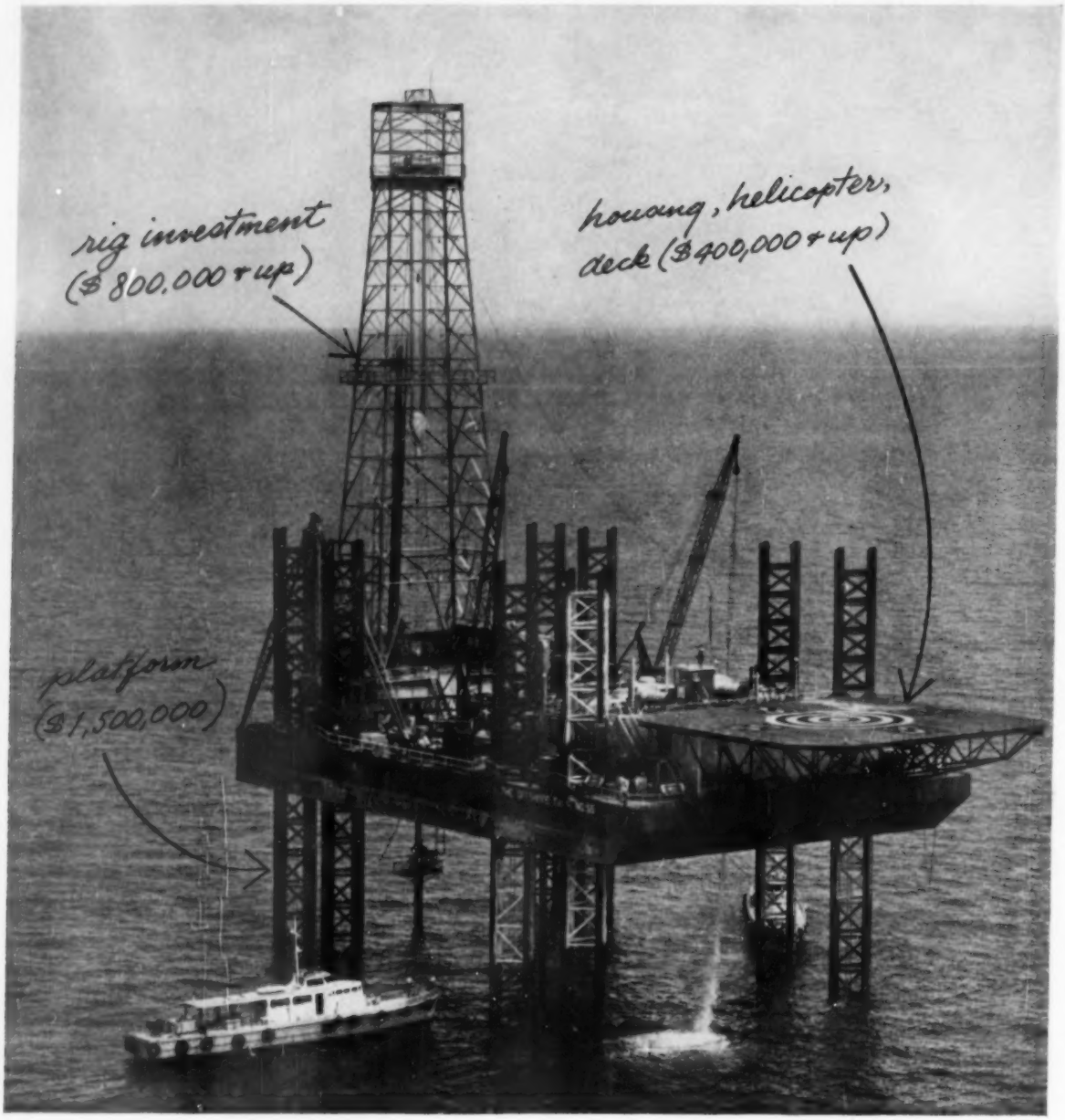
EXPORT OFFICE: 1011 INTERNATIONAL BLDG., NEW YORK 20, N.Y.

GULF COAST, MID-CONTINENT, ROCKY MOUNTAIN AND CANADIAN DISTRIBUTOR FOR MARTIN DECKER PRODUCTS

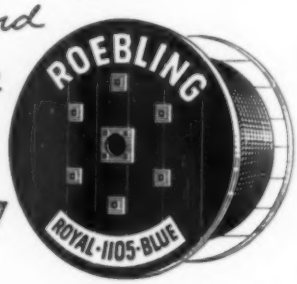


REED

REED'S ROLLIN'



When you spend
$4,000,000 for an offshore rig
you can't afford
not to use the
best rope



You wouldn't use Bargain Basement bits. You'd get the best. You'd get the best of everything; that's why an offshore rig can run as much as $4,000,000.

To settle for anything less than Royal Blue at this stage would, indeed, be "pound foolish." For Roebling Royal Blue Wire Rope represents in *its* field, the finest there is.

It is made from the toughest rope wire ever produced—Type 1105—extra high-strength improved plow steel. Royal Blue has all the hard-working advantages of preformed construction; outstanding resistance to abrasion, fatigue, impact, crushing and shock; exceptional flexibility and ruggedness. Collectively, these values add up to 15% more strength than in any other rope you have ever used.

Anything less than Royal Blue can cost you *more*. Your distributor has Royal Blue right now. Get it now and save and save and save. For information on Royal Blue, write Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, N. J.

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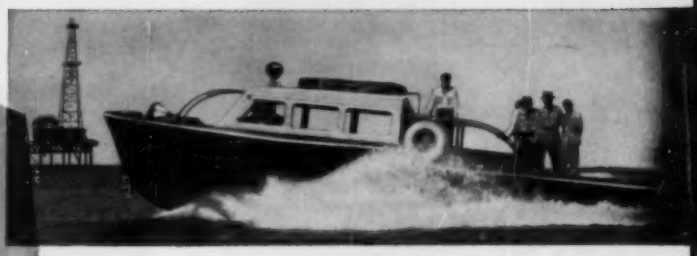

MORE WAYS THAN ONE

TO BE AN OIL MAN

Ask the toolpusher what he is, and he says he's an oil man. Ask the mud dealer, the wire line operator, the supplier. Ask the tool rental man, ask the man 'dozing the slush pits, the drilling contractor, the producer. They are all oil men. And the oil industry depends on all of them and many more.

The Oil and Gas Department of The National Bank of Commerce of Houston has helped and is helping all of these oil men. The Commerce can help you because it knows what it's talking about, and, even more important from your point of view, it knows what *you're* talking about. If you are planning to drill, if you are planning to extend needed services, if you are in the oil business, you'll find that The National Bank of Commerce will help you all the way.

E. O. Buck, *senior vice president*
Oil and Gas Department.

THE NATIONAL BANK OF

COMMERCE

OF HOUSTON

GULF BUILDING MAIN AT RUSK HOUSTON

Facilities of the Oil and Gas Department of The National Bank of Commerce of Houston are available in Wyoming, Nebraska, Colorado, New Mexico, Louisiana, Mississippi, and Texas.

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DEPOSIT
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FOXBORO d/p CELL

unequaled –

Simplest installation — orifice flange tap connections at standard spacing, are provided at both ends.

Drain and vent holes at lowest and highest points on both sides.

Purged cover protects transmitter from weather, dust, and fumes.

Over 60,000 now in use!

No zero drift . . . positive overrange protection . . . high sustained accuracy even under the most punishing operating conditions. No wonder over 60,000 Foxboro d/p Cell Transmitters have been installed since they were introduced in 1948.

By introducing the modern concept of high speed flow measurement and control, these differential pressure transmitters have *revolutionized* many an industrial process. Bulletin 13-11A shows how — and portrays the benefits the d/p Cell Transmitter offers you. Write **The Foxboro Company, 601 Norfolk St., Foxboro, Mass., U.S.A.**

FOXBORO

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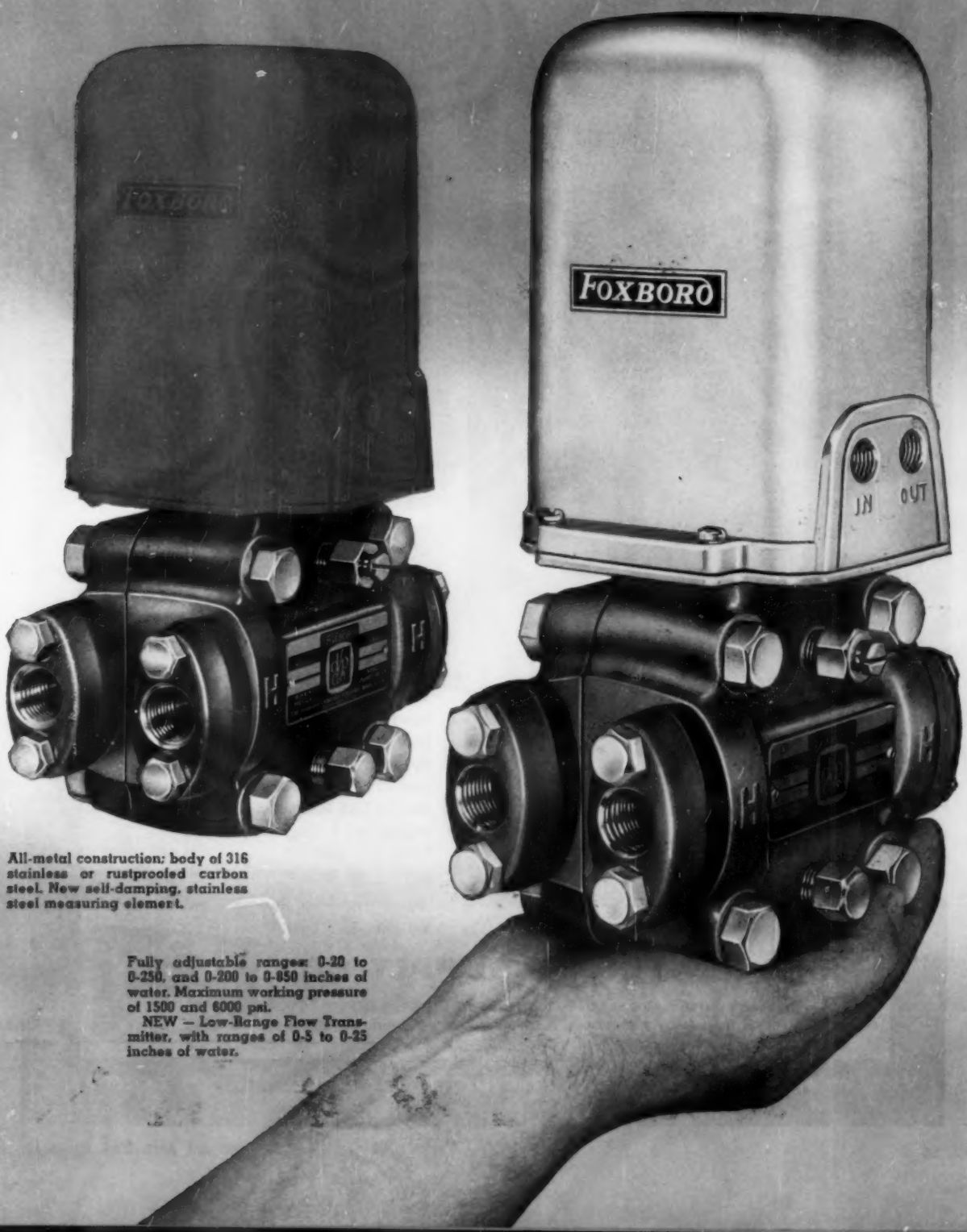
FIRST in Flow Measurement and Control

FLOW TRANSMITTERS...

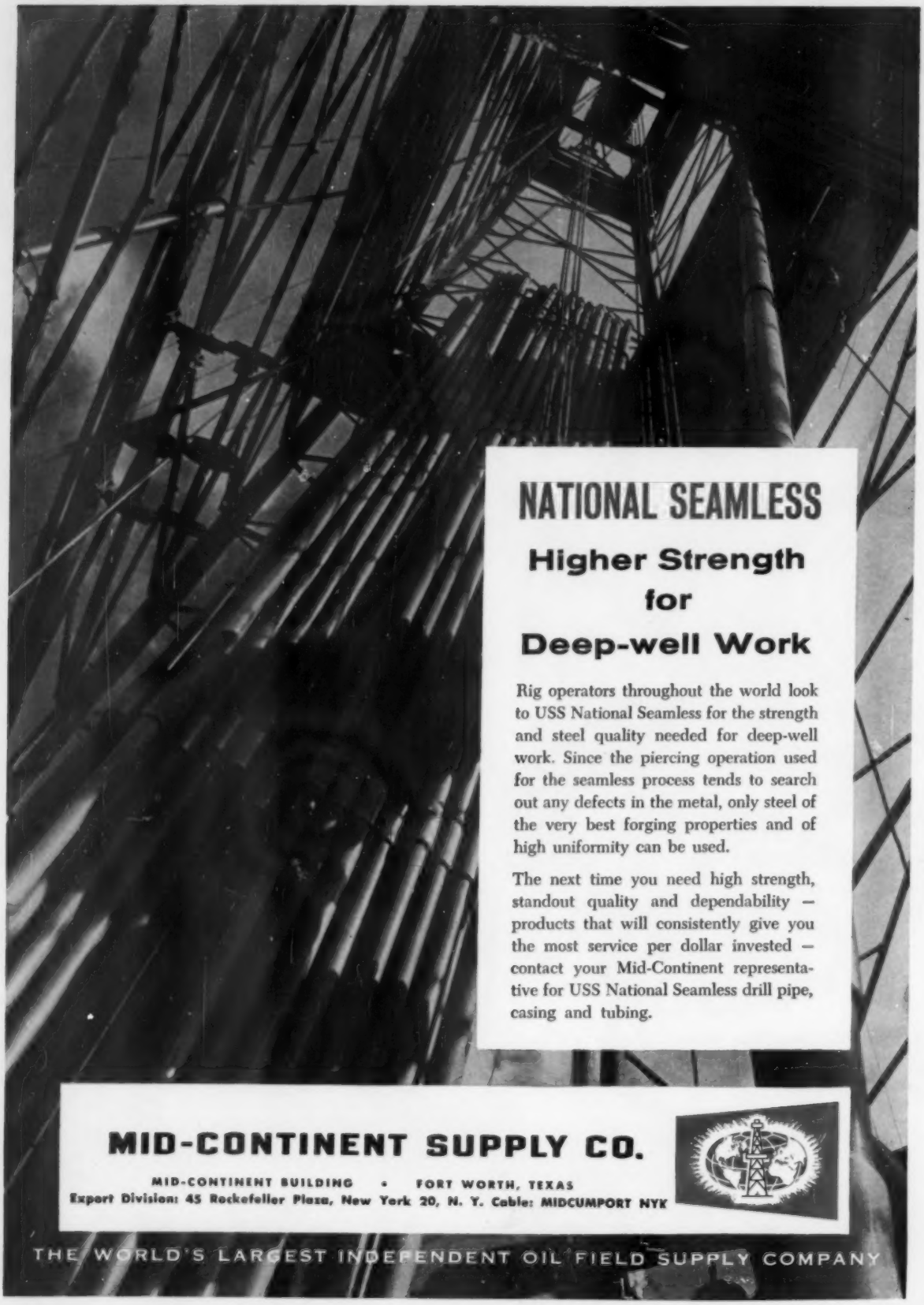
in accuracy, stability and performance



All-metal construction: body of 316 stainless or rustproofed carbon steel. New self-damping, stainless steel measuring element.

Fully adjustable ranges: 0-20 to 0-250, and 0-200 to 0-850 inches of water. Maximum working pressure of 1500 and 6000 psi.

NEW — Low-Range Flow Transmitter, with ranges of 0-5 to 0-25 inches of water.



NATIONAL SEAMLESS

Higher Strength for Deep-well Work

Rig operators throughout the world look to USS National Seamless for the strength and steel quality needed for deep-well work. Since the piercing operation used for the seamless process tends to search out any defects in the metal, only steel of the very best forging properties and of high uniformity can be used.

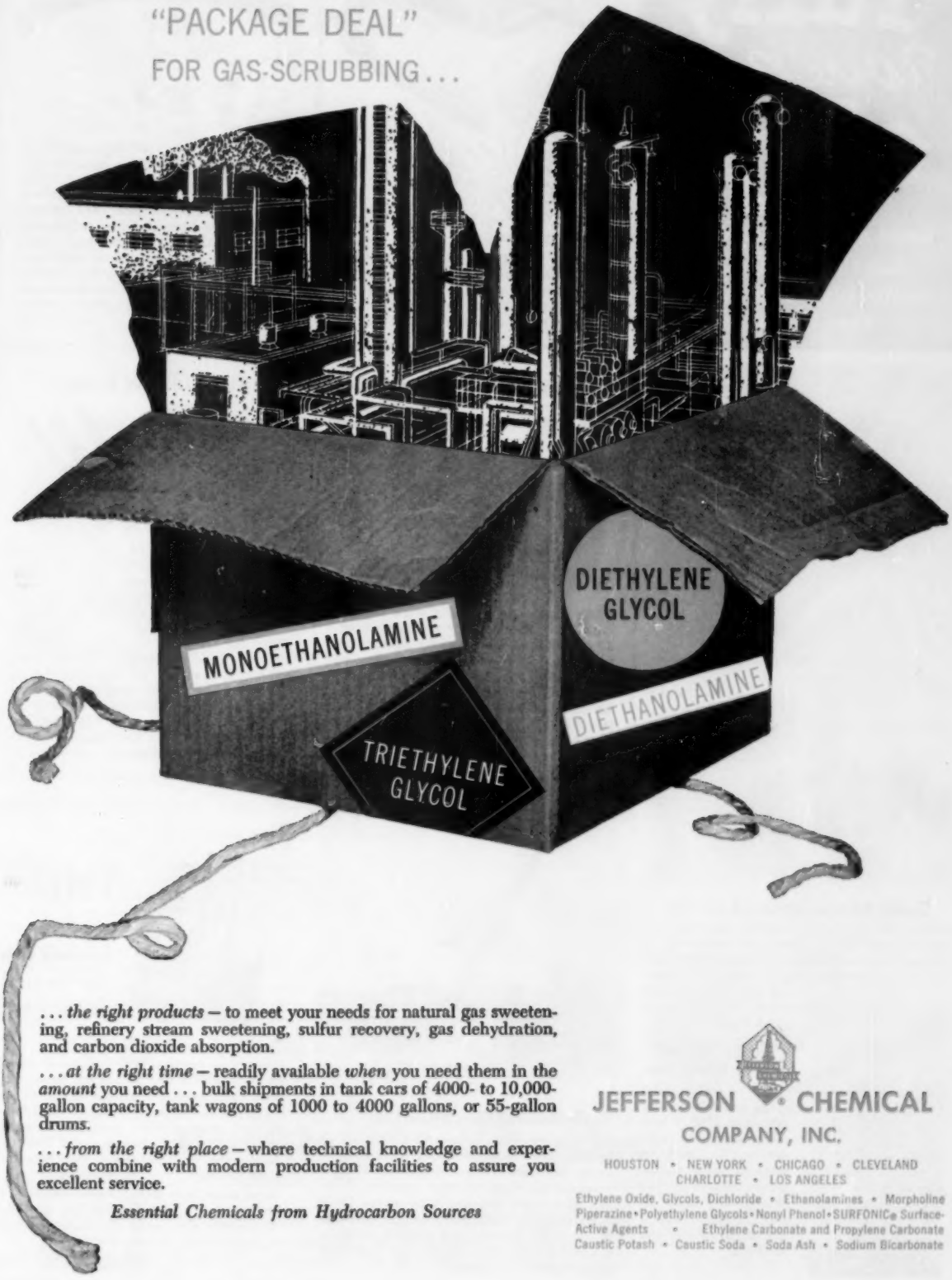
The next time you need high strength, standout quality and dependability — products that will consistently give you the most service per dollar invested — contact your Mid-Continent representative for USS National Seamless drill pipe, casing and tubing.

MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS
Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

HERE'S
JEFFERSON CHEMICAL'S
"PACKAGE DEAL"
FOR GAS-SCRUBBING...



... *the right products* – to meet your needs for natural gas sweetening, refinery stream sweetening, sulfur recovery, gas dehydration, and carbon dioxide absorption.

... *at the right time* – readily available *when* you need them in the *amount* you need ... bulk shipments in tank cars of 4000- to 10,000-gallon capacity, tank wagons of 1000 to 4000 gallons, or 55-gallon drums.

... *from the right place* – where technical knowledge and experience combine with modern production facilities to assure you excellent service.

Essential Chemicals from Hydrocarbon Sources

JEFFERSON CHEMICAL COMPANY, INC.

HOUSTON • NEW YORK • CHICAGO • CLEVELAND
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Ethylene Oxide, Glycols, Dichloride • Ethanolamines • Morpholine
Piperazine • Polyethylene Glycols • Nonyl Phenol • SURFONIC® Surface-Active Agents • Ethylene Carbonate and Propylene Carbonate
Caustic Potash • Caustic Soda • Soda Ash • Sodium Bicarbonate

Tuffy® Wire Rope Tips

Guard Against These Killers!

... Get The Full Measure of Service-Life Built In By Wire Rope Specialists

Mangled in a Wedge Socket

Here's a result of improper socketing. It was caused by using a poorly designed or worn-out wedge socket. Failure at the dead end can damage other sections of the rope, too.

Rusty Road to Ruin

Rust—No. 1 enemy of steel—takes a heavy toll in wire rope life. An insidious, silent type of killer, rust often does irreparable damage before it's even noticed. The one-strand break shown here resulted when the rope was allowed to become rust-bound through lack of lubrication. Tests show that, with other conditions ideal, properly lubricated rope has up to 10 times the life expectancy of dry rope.

Overloaded — Soon Exploded

The rated capacity of a wire rope is based on the breaking strength (catalog) divided by a safety factor applicable to the type of service or use. The grade of steel, type of construction and size of the rope determine tensile strength. It must be properly related to the loads it will carry, or costly and dangerous early failures are likely to occur.

Victim of the Bends

Excessive bending of wire rope accelerates wear. Generally, more flexible ropes are used as bending stresses increase (with decrease in tread diameter of sheave or drum). If a rope is operated on a sheave too small for its bending characteristics, early failure is certain. Through an exhaustive series of bending tests, Union Wire Rope engineers have compiled data that you can use to assure getting the rope construction that will give you the longest service life. Ask about it.

Tuffy Balanced Standard Rotary Line helped drill the world's deepest well—Wildcat I-EE in Pecos County, Texas. This rotary line is famous for top performance in use with standard rigs in any formation. It also does an outstanding job with jacknife rigs in deep drilling beyond 6000 feet.

Tuffy Balanced Jacknife Rotary Line: Made to the special needs of jacknife rigs drilling to 6000 ft. Has extra strength, with greater flexibility to move at higher speeds over the smaller sheaves and drums of jacknife rigs, and to give better reeving and spooling.

Tuffy Balanced Slings & Hoist Lines This team has made a name for cutting hoisting and downtime costs in all types of materials handling. Tuffy Hoist Line gives the balanced combination of strength and flexibility needed for a longer running rope. Tuffy Slings are made of an extra flexible, high-strength machine-braided fabric that smooths out uninjured after knotting or kinking.

FREE!

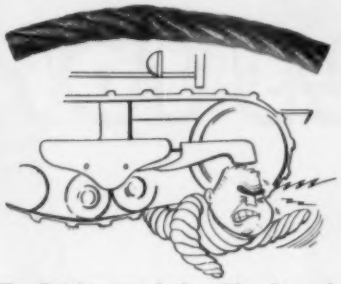
Complete handbook of wire rope use in oil field service

Latest, most complete information ever compiled on the subject in one publication. Shows the various rope constructions used by the oil industry, and gives full data tables on each. Includes (in their entirety) "A.P.I. Specifications for Wire Rope" and "A.P.I. Recommended Practice on Application, Care and Use of Wire Rope for Oil Field Service."

Write Union Wire Rope Corporation, 2102 Manchester Ave., Kansas City 26, Mo. Specialists in high-carbon wire, wire rope, braided wire fabric and stress relieved wire and strand.

01

Crushed by a Tractor Cleat

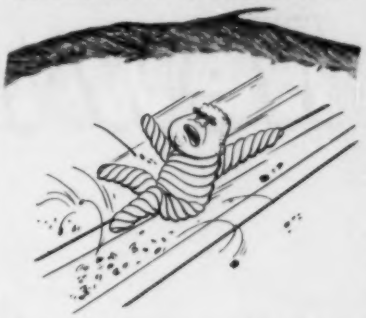


The Sunday punch for this piece of wire rope was delivered by a tractor cleat—just one of many crushing injuries caused by rope being run over or banged into by hard, sharp objects. Even the toughest wire rope is no match for this kind of mistreatment.

After a Suicide Jump

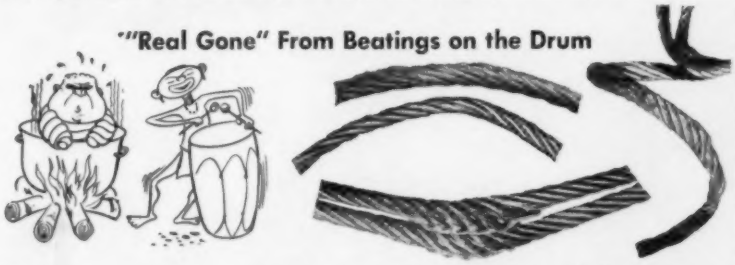
This rope jumped out of sheave and was soon destroyed by pulling around the shaft. Actually it was a case of sudden slack which threw the rope out of the sheave.

Burned on a Frozen Sheave



End of the line came quickly for this rope as the result of operating over a sheave that did not turn. Note the exceptionally heavy abrasion on one side of the rope. Sheaves should be checked thoroughly and often.

"Real Gone" From Beatings on the Drum



Even under normal operating conditions, drum wear gives wire rope severe punishment. This wear concentrates at the cross-over points and at the flange. Excessive drum crushing results from operating on small drums, excessive loading and poor winding. Smooth drums are not recommended. Here are typical "drum beatings": Cross-over wear; cross-over crushing on drum; drum crushing from poor winding; drum-crushing from small drum.

Although drum wear cannot be eliminated, its effects can be greatly reduced. Under properly engineered procedures, two and three times the service can be obtained from the same line by improving drum conditions. Union Wire Rope Engineers will help you with this problem. Get in touch with us for information.

On the "Blink" from a Kink

This open kink resulted from mishandling of rope. Guard against kinks by proper winding on the drum. Never pull a loop smaller. Always enlarge it, then straighten out the rope.

Strangled by a Misfit Sheave

When the bearing surface of a sheave is too small for the rope diameter, pinching action quickly destroys the rope — especially when it's overloaded. The victim shown here was knocked out in just 1½ hours of service.

Tuffy Wire Ropes are "Job Prescribed"—Each Designed for a Particular Type of Machine

There are thousands of wire rope constructions and Union Wire Rope specialists make them all. But, there is only one Tuffy line of wire ropes. Each Tuffy was developed and proved the one best rope for the particular work for which it is intended. It is designed as a functional part of the type of machine on which it is used.

Tuffy Wire Ropes are "job prescribed" and balanced in each prescription are all the ingredients of strength, flexibility and toughness to give you genuine relief from inefficient operation, foreshortened service life and safety hazards. You get longer service life and you cut down on your rope costs. Union Wire Rope Corporation, 2102 Manchester Avenue, Kansas City 26, Missouri.

Your Tuffy Distributor Can Help You Get The Full Measure of Service Life

UNION Wire Rope

ARMCO

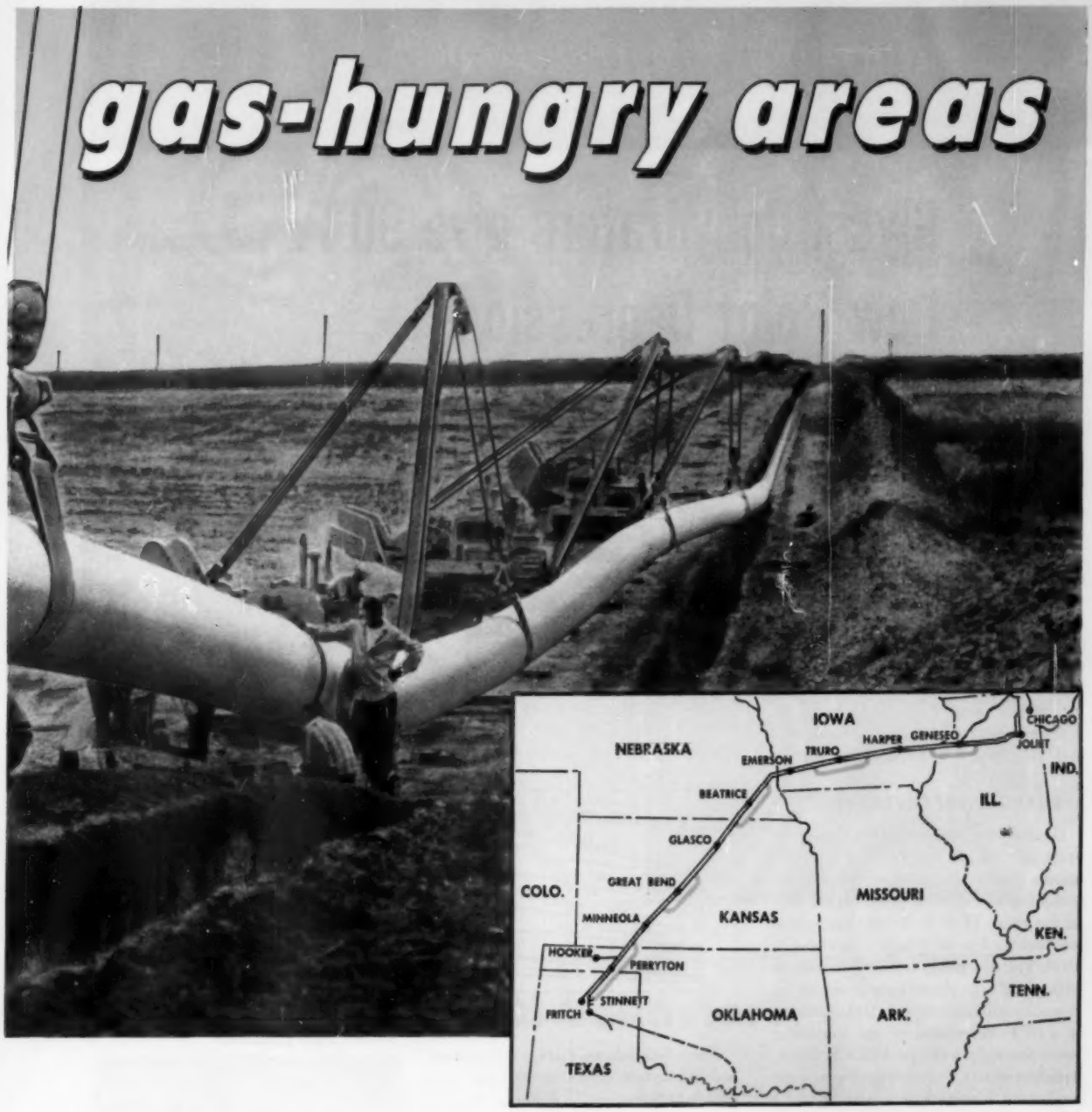
Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Southwest Steel Products

Natural Gas Pipe Line Company of America completes 513 miles of looping line in record time

Additional supplies of natural gas from the Panhandle and north-central areas of Texas will soon flow through new lines, and initial deliveries to the Iowa, Illinois, Wisconsin and Indiana markets will be increased by 100 million cubic feet per day. Nearly five hundred miles of 36" pipe and twenty miles of 26" pipe have been laid . . . will bring new gas supplies to the midwestern markets. In furnishing a little more than half this pipe, A. O. Smith Corporation is proud to have helped serve Natural Gas Pipe Line Company of America and its tremendous markets.

gas-hungry areas



For 30 years . . .

A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe made and installed in 1928 is still in operation. That's why so much A. O. Smith pipe has been used on so many important pipeline projects.

Through research . . . a better way

A.O.Smith
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TUBULAR PRODUCTS DIVISION
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Engineering Progress' Report

FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE's diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

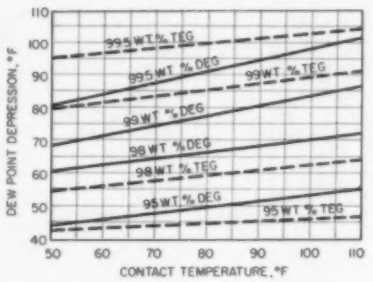
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

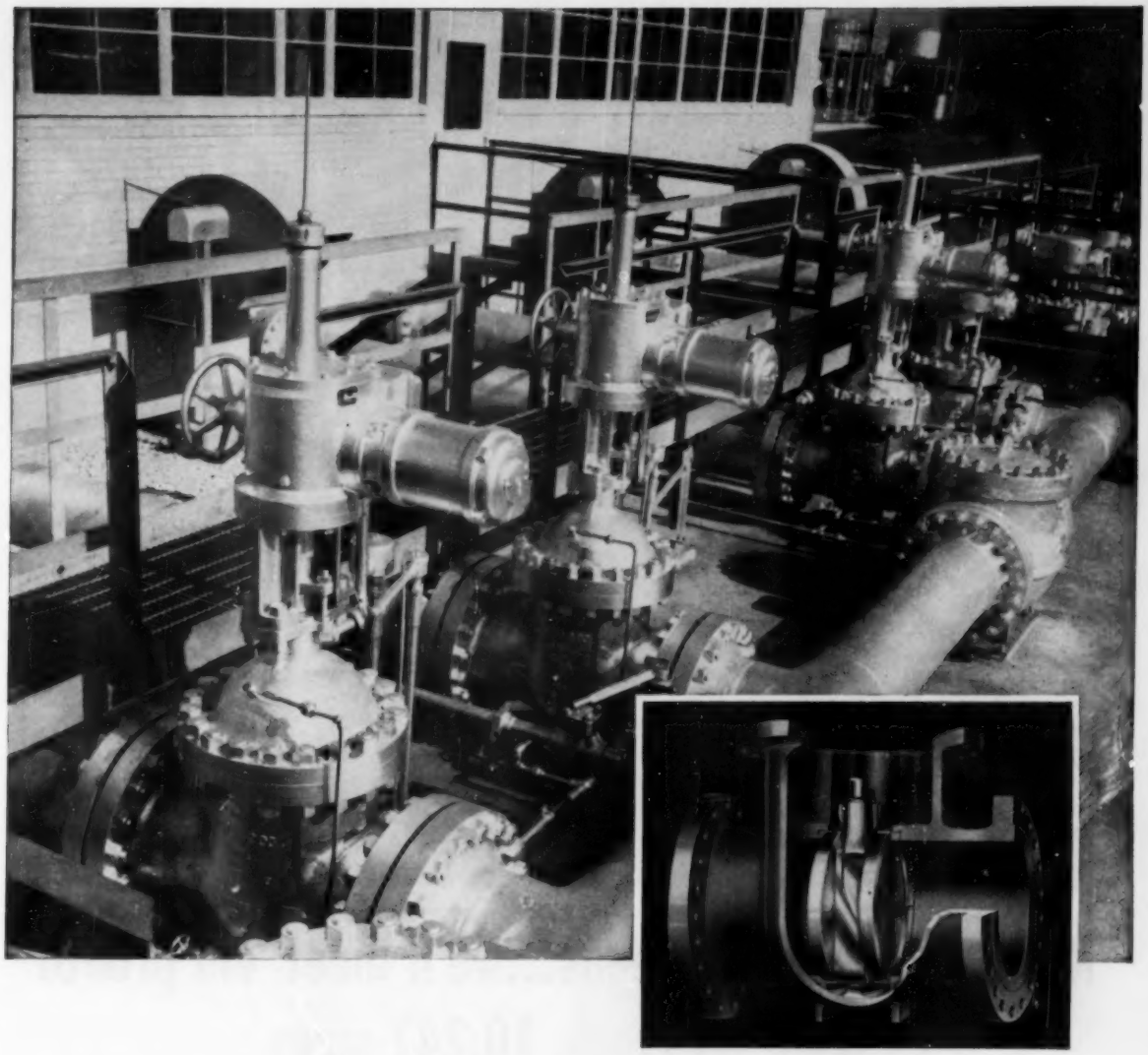
Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE's extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE's Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE's glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

"Union Carbide" is a registered trade-mark of Union Carbide Corporation

UNION CARBIDE CHEMICALS COMPANY
DIVISION OF
UNION CARBIDE
CORPORATION



Why Darling revolving double disc gate valves mean . . .

permanent good behavior!

THE reason is very simple. These valves are different! They were designed with one objective uppermost—to be uneffected by the very conditions that lead to trouble in ordinary gate valves. And so it was that Darling came up with the fully revolving double disc, parallel seat principle. It minimizes friction and avoids wear concentration. It assures remarkably easy operation with self adjustment for positive closure. It automatically compensates for any valve body deflection.

The proved result is that these Darling valves consistently show superiority in service life, low maintenance, positive operation and trouble-free performance. Savings naturally result. Write for Catalog No. 57.

DARLING VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

Name your bearing needs...we'll meet 'em pronto from 30 types, 10,247 sizes

TIME and time again, machinery makers come to the Timken Company for help with some special bearing application problem. One they think hasn't been solved before. And time after time, from our 30 types and 10,247 sizes of Timken® tapered roller bearings, we've come up with the bearing design to do the job and at minimum cost.

It's no accident that we can help out so often. In sixty years of helping machinery builders with bearing problems, we've engineered and produced the world's largest selection of tapered roller bearings. And we've constantly improved our designs. The answers to thousands of bearing application problems are already in our files. Ready and available to help you.

And machine users get the same swift service if they ever need a replacement Timken bearing. Even for old machines, they can almost always count on immediate delivery of Timken bearings for replacement.

Why not call on our engineers for help whenever you have a bearing application problem or requirement? Timken is your No. 1 bearing value. Wherever wheels and shafts turn, Timken bearings eliminate friction, cutting wear and maintenance to a minimum. Specify bearings trade-marked "Timken" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS ROLL THE LOAD

PRODUCTION ECONOMY BEGINS WITH EFFICIENT TREATING

your Tretolite service engineer can show you how

Your Tretolite service engineer, "the Man in the Red Car", provides the chemicals and the service which make this possible.

SEE OUR EXHIBIT

MAY 14-23, 1959
Tulsa, Oklahoma

The right chemical, correctly proportioned ***HERE***

...With low cuts at minimum treating cost, as indicated ***HERE***

...Result in a favorable sample ***HERE***

...And lead to accepted tanks, every time, as shown ***HERE***

TF-58-5R

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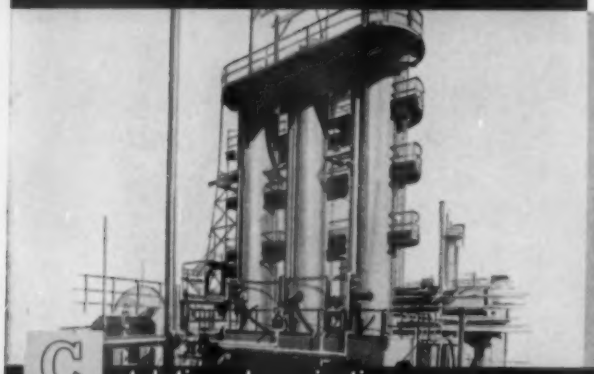
JAPAN: Maruwa Bussan KK, No. 3, 2-Chome, Kyobashi, Chuo-Ku, Tokyo
KUWAIT: F. N. Dahdah, Box 1713, Al Kuwait
MEXICO: R. E. Power, Sierra de Mijes, No. 125, Mexico, D. F.
NETHERLANDS: F. E. C. Jenkins, Hoefbladlaan 134, The Hague
PERU: International Gas Lift Company, Apartado 71, Talara
TRINIDAD: Neal and Massy, Ltd., Port of Spain, P.O. Box 544, San Fernando

Somewhere on these pages is a

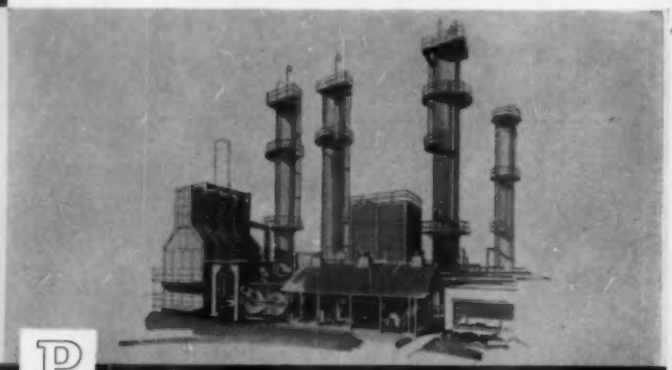
UOP

answer to most every petroleum processing problem.

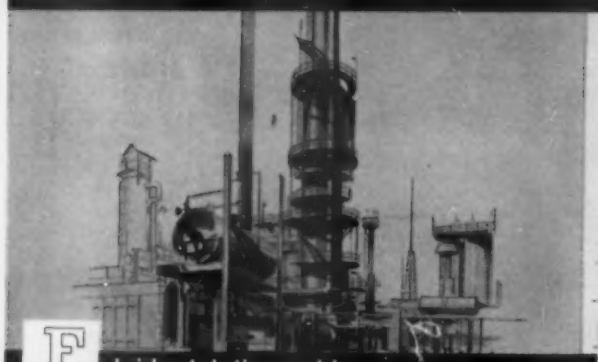
Working out the solution to a processing problem can be a pretty tough assignment for any refiner. But this is a UOP specialty and it's highly probable that UOP can come up with the right answer. Perhaps, we don't have all the answers right on tap but our more than 40 years of research and engineering development in oil refining technology is pretty good assurance that we can work them out. Quite possibly you will find



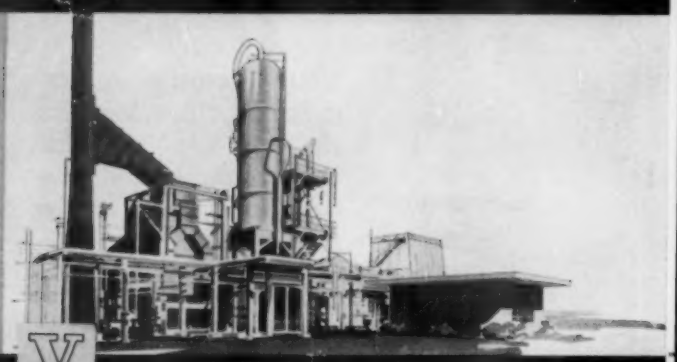
Catalytic polymerization A process for converting propylene and butylenes to high grade gasolines



Penex® The first practical process for upgrading pentane and hexane fractions



Fluid catalytic cracking Improved heavy oil conversion process for higher yields and octane numbers

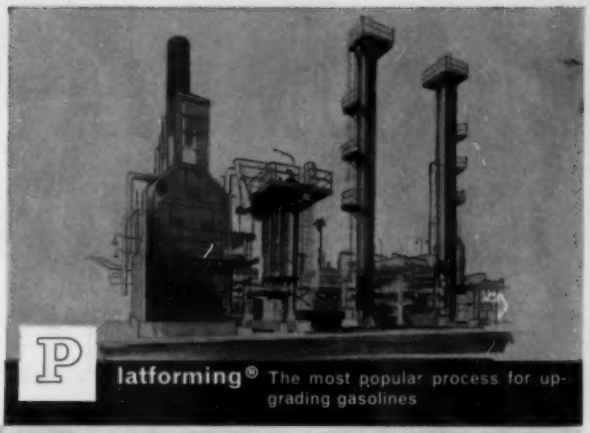


Vacuum distillation and visbreaking Efficient, economical processes for feed preparation

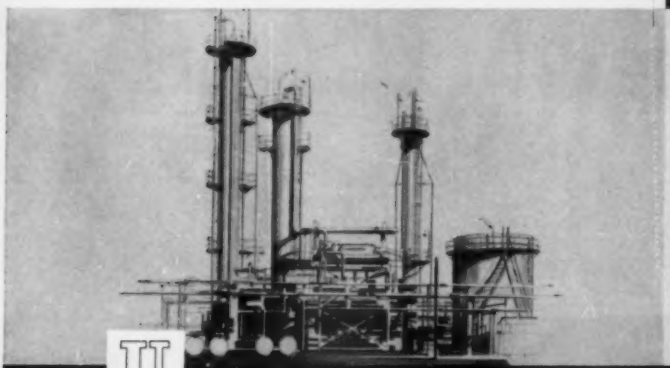
Low pressure coking A process that adds market flexibility

Rexforming® The ideal process to insure your top octane position

the solution among the processes shown here. For these represent only some of the refining and petrochemical processes UOP makes available to all refiners, anywhere. If you would like to know more about all the refining and petrochemical processes available from UOP we'll be glad to send you our handsome new 36 page brochure describing these more fully. Just drop us a line on your company letterhead.

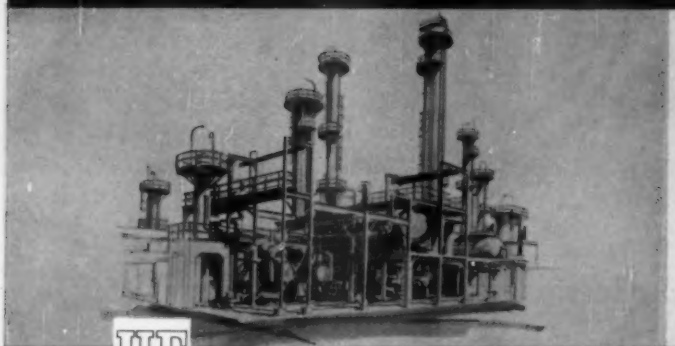


P latforming® The most popular process for upgrading gasolines



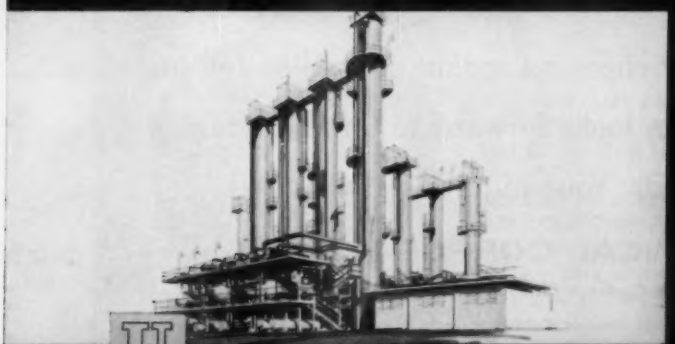
U nisol® A finishing process without octane degradation

U nifining® A modern process for completely purifying petroleum distillates



HF Alkylation A catalytic process for producing alkylate

T hermal cracking An improved design of a basic refining process



U dex® A process for separating gasoline into high and low octane fractions

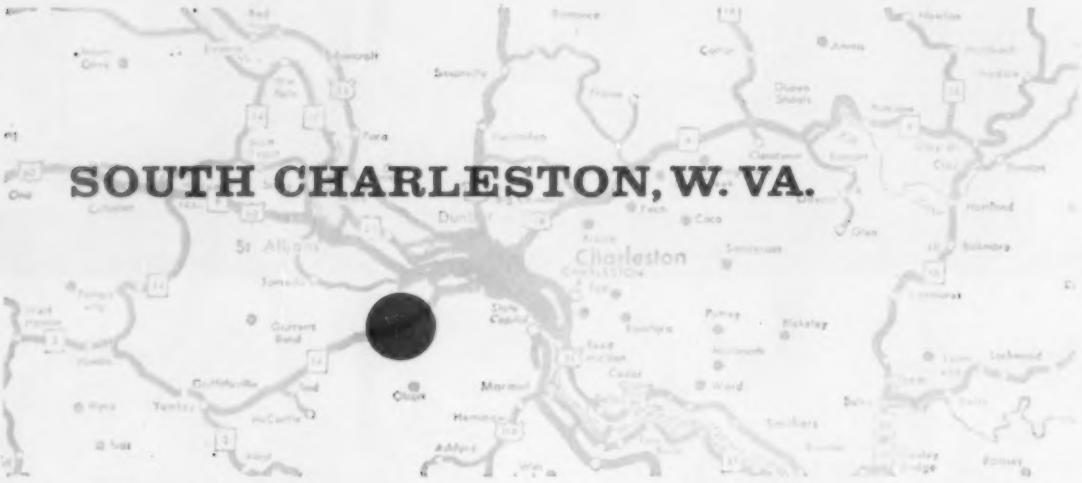
UOP® UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road
Des Plaines, Illinois, U.S.A.

MORE THAN FORTY YEARS OF LEADERSHIP IN PETROLEUM REFINING TECHNOLOGY

*Trademark

COLUMBIA-SOUTHERN ADDS ANOTHER NEW FACILITY TO SERVE YOU BARIUM CHEMICALS



Columbia-Southern announces the production of Barium Chemicals at South Charleston, West Virginia. This plant produces top quality barium chemicals, related chemicals and carbon bisulphide. The location of the plant, in the heart of the Ohio Valley chemical region, is well suited for prompt deliveries. Columbia-Southern looks forward to the opportunity of serving your barium chemical needs. Your inquiries are invited.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center • Pittsburgh 22, Pennsylvania

Anhydrous Ammonia, Barium Chemicals, Benzene Hexachloride, Calcium Chloride, Calcium Hypochlorite (Pittchlor®, Pittabs®), Carbon Tetrachloride, Caustic Potash, Caustic Soda, Chlorine, Chlorinated Benzenes, Chloro-IPC, Chrome Chemicals, Hydrogen Peroxide, Muriatic Acid, Pacific Crystals, Perchlorethylene, Rubber Pigments (Calcene®, Hi-Sil®, Silene®), Soda Ash, Sodium Bicarbonate, Sodium Sulfate, Titanium Tetrachloride, Trichlorethylene

Ajax Engines are typical of the line of quality equipment stocked and distributed through National's 130 stores.

You'll get ideas in our warehouse, too!

The truth of the old saying, "Out of sight, out of mind," often bothers us. We know that every National Supply Store is well-stocked with quality equipment like these Ajax Engines . . . but you'll probably never see much if you do all your shopping at the counter. In fact, what you see from the front counter is such a small part of our ample stocks that we'd often like to remove it!

We won't eliminate this convenience, of course. But we can urge you to walk behind it any time and get better acquainted with the *whole* National Supply Store. You'll see equipment like these Ajax Engines . . . Link-Belt Chain . . . Oilmaster Pumps . . . Tube-Turn fittings . . . Rockwell-Nordstrom Valves. The list of outstanding equipment is a long one, and we're pleased to be associated with every name on it. More important, it's equipment we know you can use to operate profitably.

So shop behind our counter, too —in places like the warehouse, equipment yard and pump shop. It's a tour you owe to yourself, because the "*in* sight, *in* mind" experience can produce some good ideas for improving your own operations. We know. We've seen it happen many times.

This view of a National Wellhead beneath an offshore rig platform shows one of the largest wellhead assemblies ever manufactured.

You get these 6 big advantages with National Wellhead Equipment—

1. **Ease of assembly**—The overall simplicity of National Wellhead design makes every unit easy to assemble and maintain. Parts are self-locating and self-activating, and no special tools or adjustments are needed for installation.

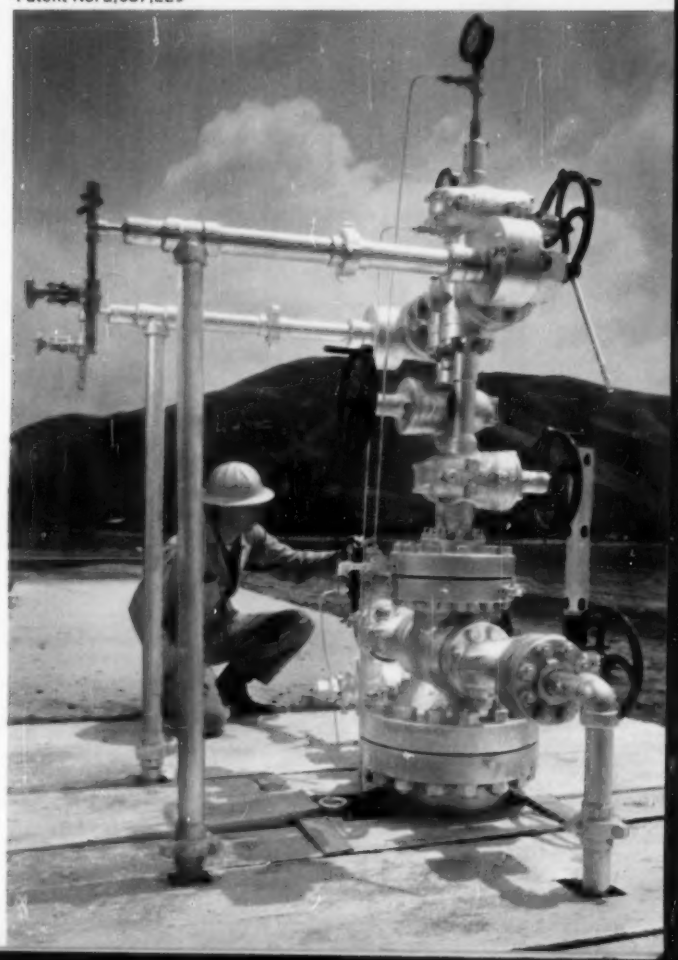
2. **Maximum flexibility**—National's precision-engineered units are interchangeable, thus permitting an unlimited number of combinations to meet your specific requirements in size, capacity and type.

3. **Pre-tested safety**—National's triple-sealed Pressure Pack design insures trouble-free performance and longer service life. Intensive pressure testing procedures are more severe than those specified by API standards.

4. **Multiple completion designs**—There are five types of dual string equipment in National's line—all designed for safe, profitable completions in a full range of working pressures. National triple completion assemblies are also available.

A "flange eye" view in National's Houston plant shows the stamping of serial numbers on units during the production process. The Houston Plant is devoted exclusively to wellhead manufacturing.

This National Supply dual completion assembly is located near Ventura, California. It utilizes the time-proven Laurent* seal to give sealed-in-steel construction for the life of the well.
*Patent No. 2,687,229



5. Readily available stocks—Through National's oilfield supply store network—largest in the world—you can readily obtain this quality wellhead equipment.

6. Experienced advisory service—Complete advisory service on any wellhead application problems is available through any National Store or office. An experienced staff of National Wellhead specialists provides help wherever needed.

With this group of advantages, you can see why it pays to use National Wellhead Equipment and the service that comes with it. Ask the National representative in your area for full details.

More National equipment for profitable production on the next page...

National Triplex Pumps are reliable on a host of oilfield pumping jobs including water-flooding, salt water disposals, and as power-oil sources for subsurface hydraulic pumps.

...and you get low-cost pumping with National Triplex Pumps!

A minimum of pumping downtime means low-cost pumping, and that's what you get with National Triplex units. They have heavy-duty housings and frames, long-life bearings, stainless steel valves, and National's time-proven lubrication systems.

Plungers, fluid ends and cartridge-type stuffing boxes are readily interchangeable to meet varying pressure and volume needs, and are available for either corrosive or non-corrosive service. In every respect, these triplex pumps show the quality construction for which all National Supply equipment is famous.

Ask the National representative in your area for more information on National Triplex Pumps—and any of the other dependable production equipment shown on this page.

Get reliable service from precision-made National Sucker Rods. They have top resistance to fatigue, shock, corrosion and impulse loads. National Sucker Rods are available in a range of grades to meet every well condition.

National Pumping Units are manufactured in 22 standard combinations, plus various long stroke and portable variations. In the range of API rated beam loads from 3,200 to 32,400 lbs., there's a unit to economically meet your needs.

National Plunger Lift can be the best production method for certain types of wells. It uses formation gas or injected gas for operation, has low initial and service costs. Equipment is also available for gas well operation to remove liquids and maintain a uniform and increased flow rate of gas.

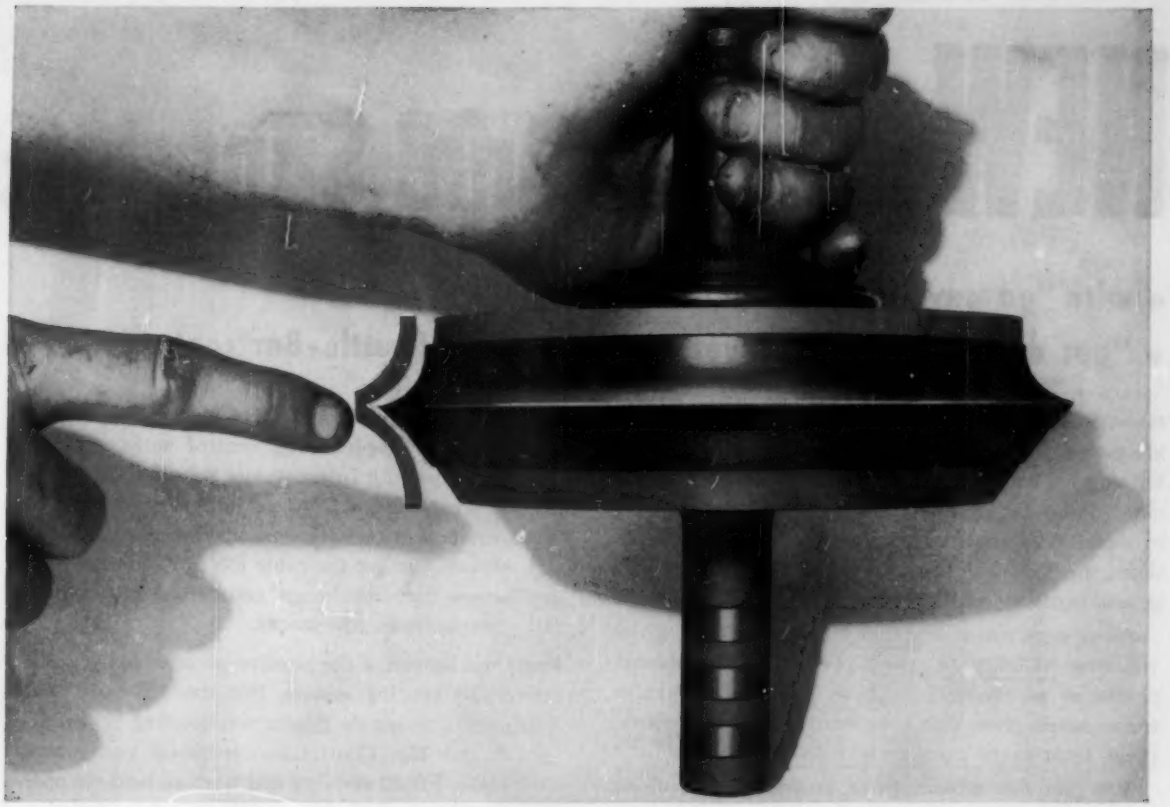
THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

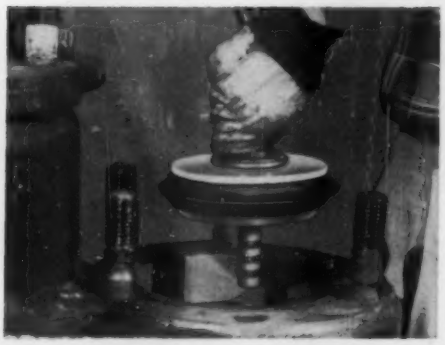
TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1



This AMERICAN IRON Double-Angle Insert is Outlasting ALL Others!



EVERY DRILLER who is using our new, exclusive double-angle inserts in American Iron Valve & Seat installations is reaping the benefits of these advantages:

- Lost circulation material is handled better.
- Perfect clearwater prime.
- More cushion is provided for valve impact on rapid close under high pressures.
- Made of finest materials, formulated and specified by our Research Laboratory, for longer-lasting more-effective service in your pumps!

For greater economy Order AMERICAN IRON Slush Pump Valves & Seats with the exclusive inserts!

Available through your Supply Store

Another AMF Product PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

AMERICAN IRON & MACHINE WORKS CO. INC. A OKLAHOMA CITY

NEW International® Superior....

• with "go anywhere" long-track traction
• "get done faster" full-reverse transmission; Shuttle-Bar control!

Now, beat "tough-problem" terrain—get big-inch lift capacity of up to 75,000 lbs.—get amazing new hill-hugging stability and bog-beating traction. Put the new 134-hp International Superior TD-20 sideboom to work! With the new 7 roller* tracks and 26-inch shoes, the TD-20 sideboom gives you the tremendous ground contact area of 5668 square inches!

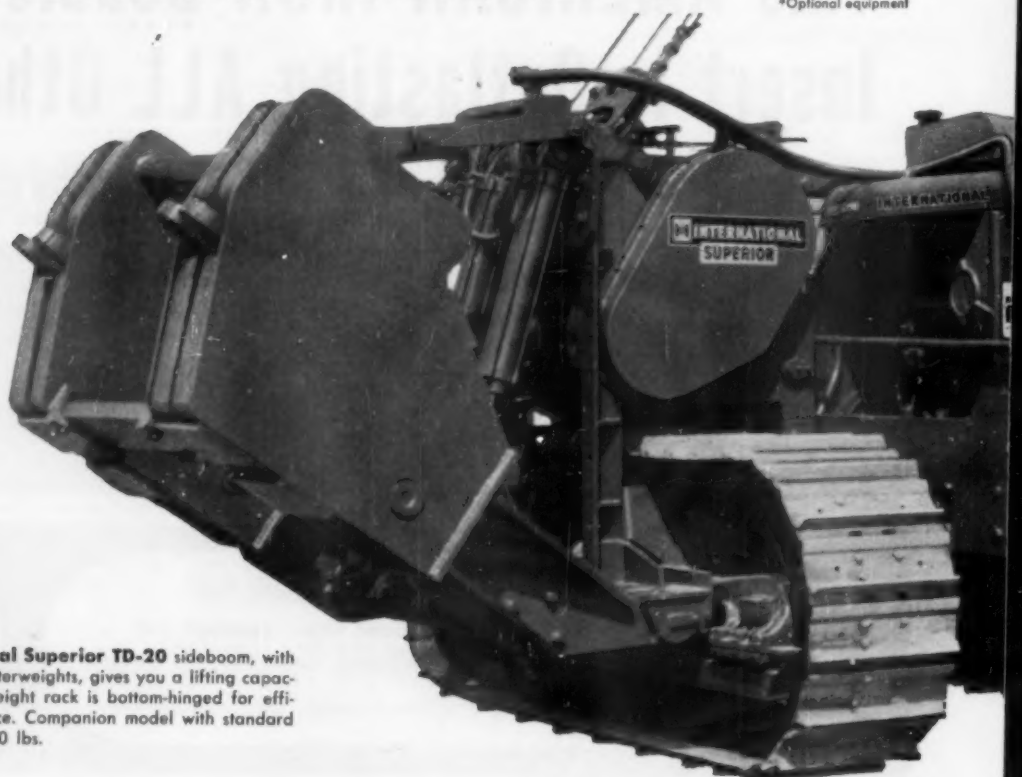
Along with this new stability the new TD-20 gives you new mobility to speed up all tractor-powered phases of pipelining. The new 6-speed full-reverse transmission gives you a forward or back-up speed range to fit every carry or travel situation.

You take fast advantage of forward speeds up to 7.0 mph and reverse speeds up to 8.4 mph! Simply move the exclusive minute-clipping Shuttle-Bar forward or backward for instant forward-reverse direction changing with or without gear changing! You get super-fast pipe-handling control with minimum operator effort with International Superior reach-easy control lever clusters. You get exclusive gear-driven drum shafts that operate without adjustment, clatter, or backlash. You get the cable life protection of fleeting sheaves—"minute-change" counterweighting—many other years-proven advantages.

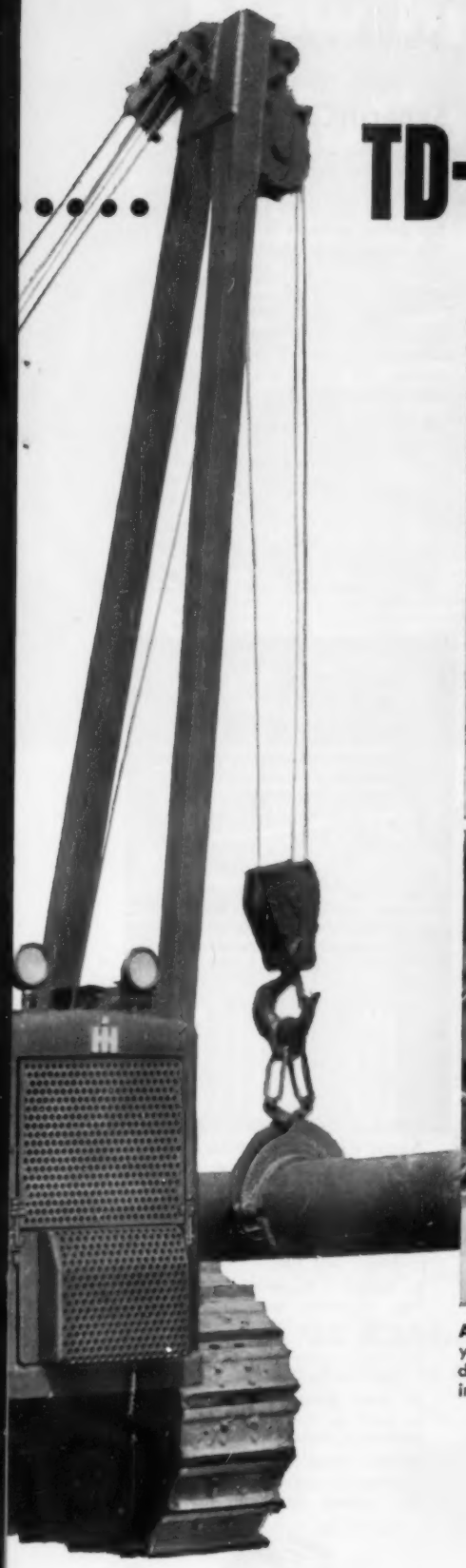
Press the button of the positive, seconds-fast gasoline conversion starting system. Put the 134-hp TD-20 Sideboom through its production-boosting paces. See how Shuttle-Bar Control can speed-up your operations—how TD-20 stability and traction increase operator confidence. And try out TD-20 sideboom safety and ease of control. See your International Superior Distributor for a demonstration.

*Optional equipment

You are cordially invited to visit International Harvester's Hospitality Suite during the Pipeline Contractors' Association Convention, at Bal Harbor, Florida, January 12-15.

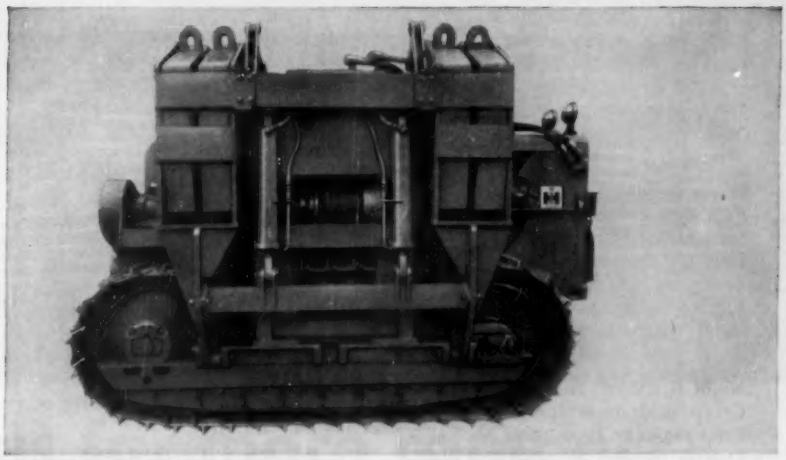


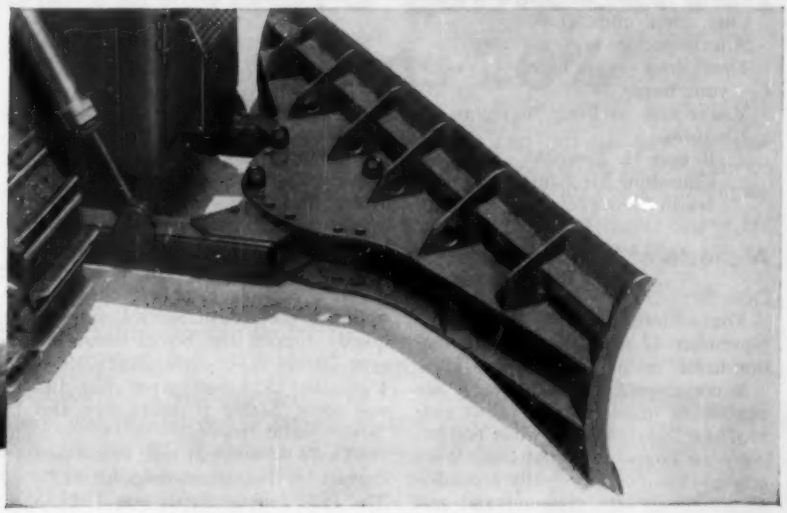
New 134-hp International Superior TD-20 sideboom, with hydraulically extended counterweights, gives you a lifting capacity of 75,000 lbs. Counterweight rack is bottom-hinged for efficient soft-ground performance. Companion model with standard counterweights lifts to 40,950 lbs.



TD-20 Sideboom

The four pin-locked counterweights of either TD-20 sideboom model can be racked or removed in minutes! It's easy to counterweight a TD-20 sideboom to match load and terrain.





Add this blade backfiller—and save the cost of a backfilling machine on your spread—for a small fraction of a complete dozer outfit's cost! Backfiller does not interfere with sideboom operation; can be put on or taken off in minutes!

International Harvester Company, Chicago 1, Illinois

INTERNATIONAL®
SUPERIOR

They Say—

Song for the Still Cleaners

Dear Sir:

Maybe some of The Oil and Gas Journal readers who have swung a sledge at one time or another would like this rhyme about the still cleaners:

Swing your sledges through the night,
Swing 'em fast, swing 'em hard.
Moon is saffron through the haze
Pitch coke gleams in fiery maze.
Hack it from the still's red gut,
Fling it down the street's wet rut.
Never rest, never groan,
Back your sledge with blood and bone.

Never mind the bitter fumes,
Pant and cough, weep and choke.
Stars are dying in the smoke
Feet are burning on the coke.
Swing and gasp, strain and reel.
Faster, harder, you can't feel!
Slash that pitch, pry it out,
Show your muscles, husky lout.

Night is ending, still's rough clean,
Creep inside to scrape and peen.
Chip the coke from inner shell,
Dawn's outside but you're in Hell!
Chip, chip, chip, chip.
Still inspector says it's clean?
Then drop your hammers, salve your burns,
You're free to live—'til night returns.

Robert H. Emerick
Consulting Mechanical Engineer
North Charleston, S.C.

A choice of business aims

Dear Sir:

The editorial in the Journal for November 17 urges oil to give attention to its "mental health."

It comments that the industry "appears to be milling around rather aimlessly . . . marking time while pondering what course it should take. What is needed is a cause to rally around—something to add meaning and zest to the day-to-day business of making a living out of oil."

On another page of the same issue is a pronouncement by a professor of the University of Chicago: "Corporations are not people. Their sole responsibility is to make as much money as they can."

I recognize full well the importance of profits. They are essential, and it is under the profit system that we have built up our magnificent industrial structure.

But if oil companies have as their sole responsibility to make as much money as they can, what defense have they against the desires of labor to wring out the last penny by force, or government to tax for all the traffic will bear? And can we expect a warm welcome from foreign lands if we seek maximum profits as our exclusive aim?

We are entitled to a profit, indeed, obliged to make a profit, but we should be committed to reasonable profits, exploiting the resources of this and other countries not simply for our own good but to raise living standards.

In Biblical times, near the end of his life Joshua demanded of the Israelites, "Choose you this day whom ye will serve."

Is not the need of a cause to rally around for which The Oil and Gas Journal pleads just as clear a call to choose—to choose between business practiced to make as much money as it can, and business—at a profit, to be sure—dominated by the motive of serving humanity?

C. D. Lowry, Jr.
Consultant
Chicago

Loffland tops Russia 'record'

"One recent Soviet claim is that of establishing a new world drilling record of 128,572 ft. of hole in 1 year with a single rig. Apparently Pravda, which reported this accomplishment, failed to check the drilling report of Loffland Brothers Co. Rig 128.

"Hard-working Rig 128, operating in the Venice area of South Louisiana, quietly topped the Soviet claim by over 70,000 ft. of hole during 1957. Even the 1956 footage of Rig 128 was some 23,000 ft. more than this 'Soviet world record.'

"That's 67 miles of hole in the past 2 years for this rig; 38 miles for 1957. The 1957 footage figure was 199,288 on 21 wells with an average depth of 9,490 ft. The average footage per day of drilling was 832.4."

Article in "Drilling Is Our Business, World Wide," magazine of Loffland Brothers Co.

(Editor's note: Anyone else ahead of the Russians?)

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

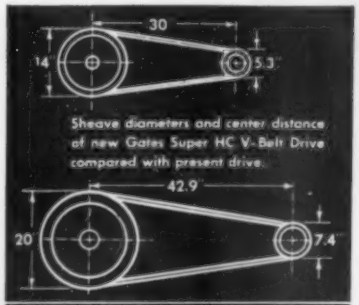
How savings multiply with new Gates Super HC V-Belt Drive

The cost of a new Gates Super HC V-Belt Drive is as much as 20% less than the cost of a drive of comparable hp using present V-belts. But the lower cost of the drive itself is only the initial *purchasing* economy.

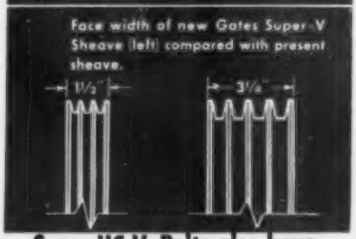
Further economies are realized on drive equipment, such as housings and bases — economies in materials, production time, shipping costs.

Shown below are space savings of a typical installation . . .

	Present Drive	Super HC Drive
DriveR Sheave	7.4	5.3
DriveN Sheave	20.0	14.0
Center Distance	42.9	30.0
Belts	4-B128	3-3V900



Sheave diameters and center distance of new Gates Super HC V-Belt Drive compared with present drive.



Face width of new Gates Super-V Sheave (left) compared with present sheave.

Super HC V-Belts also have these important Gates features...

1. Flex-Weave Cover (U. S. Pat. 2519590) A Gates exclusive. Makes cover more flexible . . . prolongs belt life.

2. Concave Sidewalls (U. S. Pat. 1813698) become straight as belt bends insuring uniform contact with sides of groove. Uniform contact means less wear . . . far longer belt life.

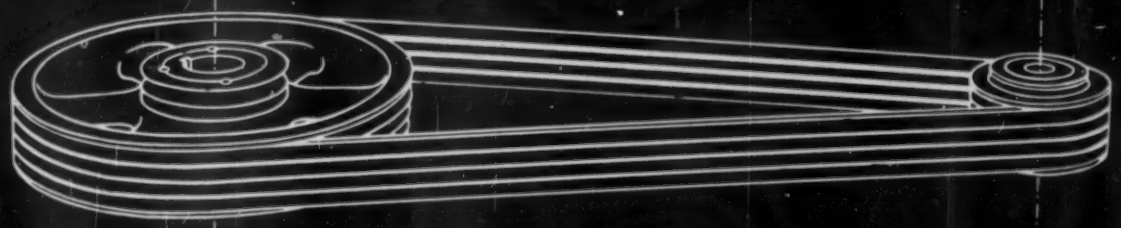
3. High Electrical Conductivity is built in for safer drives in explosive atmospheres.

4. Oil, Heat and Weather Resistance is insured by use of special rubber compounds.

Gates

New high capacity V-belt revolutionizes drive design

NEW, COMPACT GATES SUPER HC DRIVE



PRESENT V-BELT DRIVE

Makes drives far more compact... cuts cost as much as 20%

Here is a major advance in the field of power transmission — the fully proved Gates Super HC V-Belt, developed in the world's largest belt-testing laboratories at The Gates Rubber Company.

With the Gates Super HC V-Belt, you can have the lowest-cost, lightest-weight, most compact multiple V-belt drive you can put on any machine! Sheave diameters can be reduced up to 50%, sheave widths 30% to 50%, center distances 20% and more!

On new drives, the cost of a Gates Super HC V-Belt Drive is as much as 20% less than present V-belt drives of the same hp capacity!

Learn More About The Cost-Saving Super HC Drive

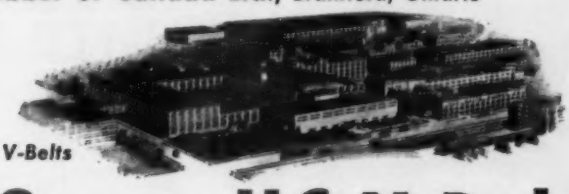
For detailed information on the Super HC Drive, contact your nearby Gates distributor or Gates Office for new booklet, "*The Modern Way to Design Multiple V-Belt Drives.*" For utmost space, weight and dollar savings in new drives or drive replacements, specify Gates Super HC V-Belts and Sheaves. Stocks immediately available in principal industrial centers.

The Gates Rubber Company Denver, Colorado

Gates Rubber of Canada Ltd., Brantford, Ontario

Gates

World's Largest Maker of V-Belts



Gates Super HC V-Belt Drives

How to Curtail

Production Expense

Cabot adjustable-crank units are made to handle polish rod loads from 7,000 to 32,000 pounds. Replacement parts and factory-trained service men are available 24 hours a day.

An example of **Cabot** pioneering is the patented tail bearing, eliminating 62 conventional parts. It requires no attention or lubrication, and dampens shocks from sucker rods. **This bearing is covered by an 8-year service policy.**

Cabot cranks are easily adjusted by one man, standing on the ground.

Cabot reducers have Sykes-cut herringbone gears in a one-piece housing. Reducer shafts require no oil seals. **Cabot reducers are covered by a 5-year service policy.**

The **Cabot** line also includes beam-balanced units for polish rod loads from 3,000 to 11,000 pounds.

The prime purpose of a **Cabot unit** is to help you minimize production costs. If you are seriously interested in curtailing production expense, you should consider **Cabot units** — NOW! Call your J&L Supply number or write us at Tulsa, P. O. Drawer 2481.

Jones & Laughlin

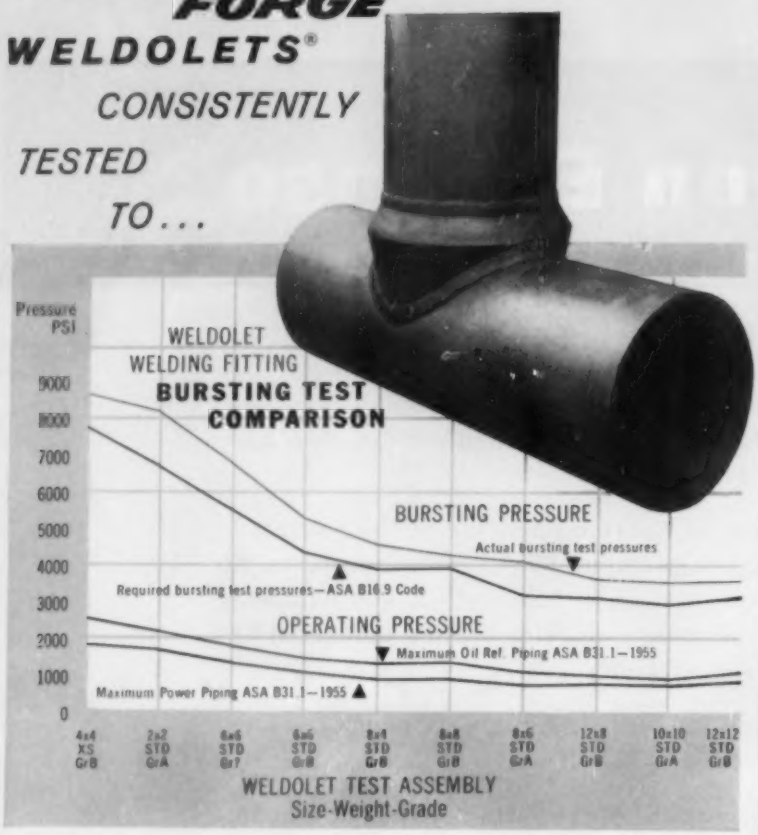
SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

BONNEY FORGE

WELDOLETS®

CONSISTENTLY TESTED TO...



...OVER 4½ TIMES MAX. OPERATING PRESSURE

"Shape of Reinforcement"—has been pioneered by Bonney for the past 20 years. The fact that shape is as important and even more important than area replacement for branch reinforcement is now gaining wide industry recognition. Even though Weldolets *do* have sufficient area replacement, the factor setting them apart from conventional lap type reinforcement is their SHAPE... Reinforcement close to the juncture—completely bonded homogeneous reinforcement avoiding cracks, fillet welds, and re-entrant corners—reinforcement tapering at the sides to prevent abrupt change in thickness where fitting joins header pipe.

Recent design improvements in the Weldolet line, based on extensive stress analysis tests, provide all these desirable "shape" factors. Specify and use Weldolets for all your full size and reducing branch connections. They are available in carbon steel and all alloys for any piping service.

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WELDOLETS®
THREDOLETS®
SOCKOLETS®
ELBOLETS®
BRAZOLETS®
SWEEPOLETS®

CARBON STEEL
STAINLESS
ALLOY
for all services

BONNEY FORGE and TOOL WORKS
ALLENTOWN, PENNSYLVANIA

CALENDAR OF EVENTS

JANUARY

12-14 Pipe Line Contractors Association, eleventh annual convention, Americana Hotel, Miami Beach, Fla.

12-16 Society of Automotive Engineers, annual meeting and engineering display, Sheraton-Cadillac and Statler hotels, Detroit.

16-17 Association of Oilwell Servicing Contractors, annual meeting, Baker Hotel, Dallas.

21-22 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Ben Milam Hotel, Houston.

22-23 National Association of Corrosion Engineers, Houston section, annual short course, University of Houston campus, Houston.

22-23 American Chemical Society, Southeastern Texas section, third biennial symposium on hydrocarbon chemistry, Shamrock Hilton Hotel, Houston.

22-24 Texas Society of Professional Engineers, annual convention, Shamrock Hilton Hotel, Houston.

23 Natural Gasoline Association of America, Oklahoma regional meeting, Biltmore Hotel, Oklahoma City.

26-29 Tenth annual plant maintenance and engineering conference, sponsored by Clapp & Poliak, Inc., Public Auditorium, Cleveland.

28-29 Annual Midwest Welding conference, sponsored by Armour Research Foundation of Illinois Institute of Technology, and American Welding Society, Chicago section, Illinois Institute of Technology, Chicago.

30-31 Oklahoma Society of Professional Engineers, annual meeting, Mayo Hotel, Tulsa.

FEBRUARY

1-4 American Association of Petroleum Geologists, Rocky Mountain section, ninth annual meeting, Civic Auditorium, Albuquerque, N. M.

1-6 American Society for Testing Materials, D-2 committee on petroleum products and lubricants, Sheraton-Jefferson Hotel, St. Louis.

2-22 Southwestern Legal Foundation, short course on oil and gas law, Southwestern Legal Center, Dallas.

11-13 Southwestern Legal Foundation, tenth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

11-13 National Association of Corrosion Engineers, Tulsa section, tenth annual pipeline corrosion short course, Mayo Hotel, Tulsa.

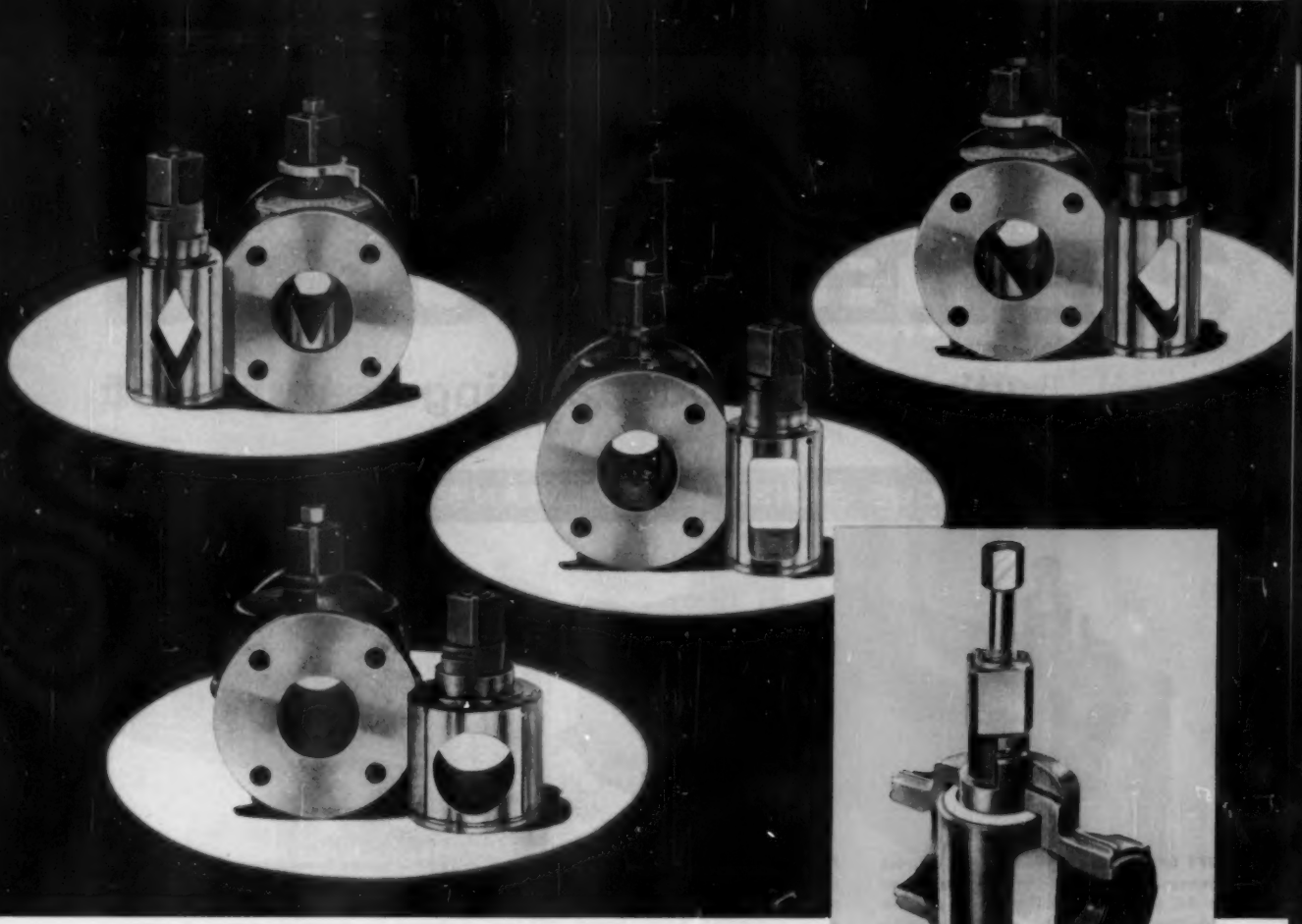
16-18 American Management Association, seminar on management problems of exploration and production, Hotel Astor, New York.

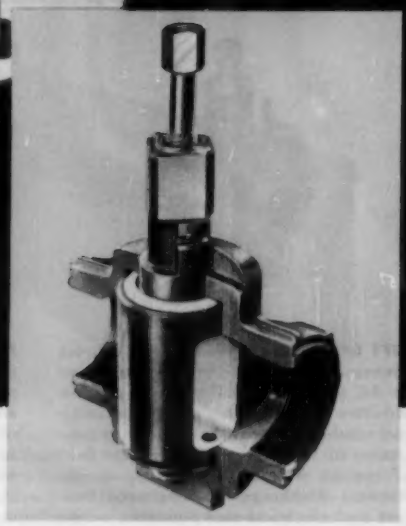
15-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Sir Francis Drake Hotel, San Francisco.

24-25 University of Oklahoma, sixth geological symposium, Norman, Okla.

27 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

26-28 Pipe Line Contractors Association of Canada, fifth annual convention, Castle Harbour Hotel, Bermuda.





W-K-M's *Creative Engineering*

assures the dependable performance of W-K-M's ACF Lubricated Plug Valves

Lubricated plug valves are the work-horse valves of industry. They're versatile, they're economical, they're readily available.

But one lubricated plug valve is not "just as good as another!" The ACF Cylindrical Plug Valve has many advantages.

W-K-M's creative engineering has designed the ACF valve to give you longer life, greater efficiency, minimum maintenance. W-K-M production pays constant attention to the manufacturing details that spell the difference between a "pretty good valve" and the best you can use. W-K-M tests every ACF valve against requirements much beyond the use for which it is rated.

In short, W-K-M's creative engineering assures you *dependable performance* from every ACF Lubricated Plug Valve in your plant.

Advantages of ACF® Lubricated Plug Valves

These versatile valves have full pipe area openings. They provide through-conduit flow with minimum turbulence and minimum pressure drop.

They can be installed in any position. They can be serviced quickly.

They are safe against rupture while lubricating—excess lubricant escapes visibly to the atmosphere around the neck of the plug; this eliminates build-up of lubricant pressure, prevents lubricant from escaping into the line.

Lubricant protects against corrosion.

Available in semi-steel, Ni-resist, carbon steel, bronze and aluminum.

WRITE FOR CATALOG 400

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

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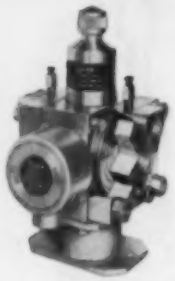
Taylor Instrument Companies

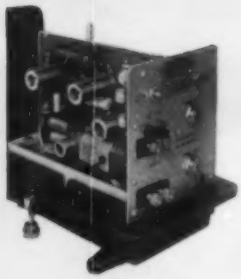
ELECTRONIC

with all the outstanding features of

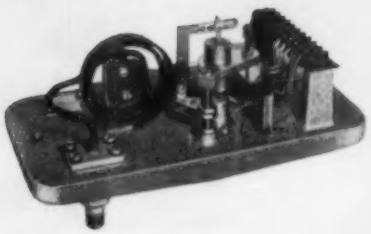
INSTANTANEOUS SENSING AND TRANSMITTING UNITS



707T DP Transmitter. It provides direct conversion from differential pressure to an AC signal. No maintenance . . . insensitive to vibration . . . self-draining and venting . . . positive over-range protection to 1500 psi . . . no process fluid in contact with internal parts, double stainless diaphragm seal between process and electrical components . . . no stuffing box, no bending members, no pivots, no flexible diaphragms nor torque tube seals. No vacuum tubes, no transistors—only a simple differential transformer. Highly linear adjustable silicone damping. Perfect for all flow applications. External zero, with wide range of zero suppression. Designed for use in Class I, Group D, Division I areas.



700T Potentiometer Transmitter. Unsurpassed for sensing and transmitting Temperatures (either thermocouple or resistance elements), Load, Speed, pH, or other millivolt signals. Electronic balancing eliminates the need for slide wires, batteries, standard cells or moving parts. Continuous vernier adjustment of span or zero is simplest on the market.
Interchangeable plug-in service "cans" permit quick adaptation of one instrument for use with different primary elements. Amplifier plugs in for simple servicing. Infinite sensitivity to the input signal. Weatherproof case permits field mounting. Users consider it the finest potentiometer transmitter available.



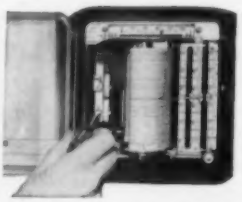
705T Pressure Transmitter. Bourdon tube senses pressure changes and moves the core of a differential transformer to change its electrical output. A simple, extremely dependable unit, built for many years of trouble-free service. Simple span and zero adjustments. Pressure ranges from absolute to 2000 psi.

• • •

See your Taylor Field Engineer for full details or write for Bulletin. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Ontario.

VALVE POSITIONER

A true electro-pneumatic valve positioner, permits full utilization of the superior performance of electronic control, coupled with the power and smooth throttling action of pneumatic diaphragm motors. Pneumatic high-capacity, leakless booster relay is easily accessible for maintenance without exposing the electrical system. Unmatched stability due to powerful balanced armature reduces susceptibility to shock and vibration to a minimum. Designed for Class I, Group D, Division I areas.



1. Front Adjustments and all the features of the famous 90J Transcope Pneumatic Recorder. With chart, pen and set-point side-by-side (as in Transcope Pneumatic Recording Controllers) all pertinent process information is immediately visualized. Hence operators make fewer mistakes. All available in one 6″ x 6″ cutout.

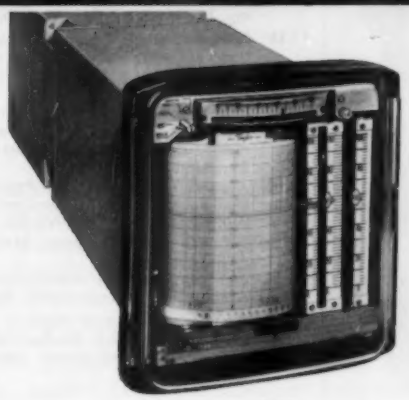
Taylor Instruments

sets new standards in

INSTRUMENTS

the highly successful TRANSCOPE* line!

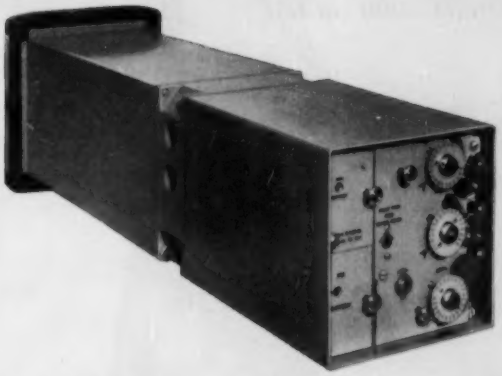
AC or DC RECORDER



Parallels electronically all the features of the TRANSCOPE Pneumatic Recorder that have won such wide acclaim. Positive, precise pen positioning provided by actual servo-motor, hundreds of times more powerful than meter type movement. Control settings and adjustments can be made from front or rear of case. Recorder can be removed without disturbing process control. Bumpless manual-to-automatic transfer is obtained without manual matching of set point and process. Plug-in Set Point Transmitter permits uninterrupted control.

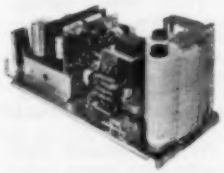
All transistorized (solid state), the 701J Recorder is unaffected by ±10% line voltage variation; thus there is no need for an expensive constant voltage source. All principal assemblies and sub-assemblies are plug-in type for flexibility and easy accessibility.

AC or DC CONTROLLER

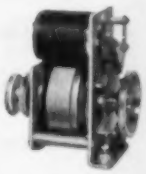


Embodies all the advantages of the most advanced control circuits. The unique diode limiter circuit permits even the two-response controllers to eliminate overpeaking on most applications. It is effective *at all times*, whether the variable is approaching control point from above or below; on changes in set point; following major process disturbances; or on start-up.

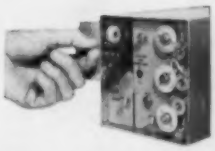
Interchangeable, plug-in assemblies permit conversion to either fast or standard reset and two-response or three-response controllers. Unparalleled rangeability makes this a universal controller. Unaffected by line voltage changes up to ±10%. Controller signal gives multiple valve operation. Output signal from 1-5 Ma feeds into any load from 0-10,000 Ohms. Plug-in assemblies: control responses, operational amplifier, AC/DC Converter, DC reference supply and controller.



2. Interchangeable Recorder Slide. Completely transistorized. Unaffected by a supply voltage change up to ±10%.



3. Powerful Servo Motor gives more precise pen positioning than ever before. More accurate records.



4. Plug-in Controller Sub-Assemblies. Printed circuit boards, mercury bottle disconnect switch.

5. Extremely Stable Controller Amplifier, utilizing latest design techniques and premium components.

*Reg. U.S. Pat. Off.

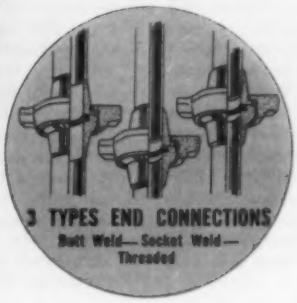
MEAN ACCURACY FIRST

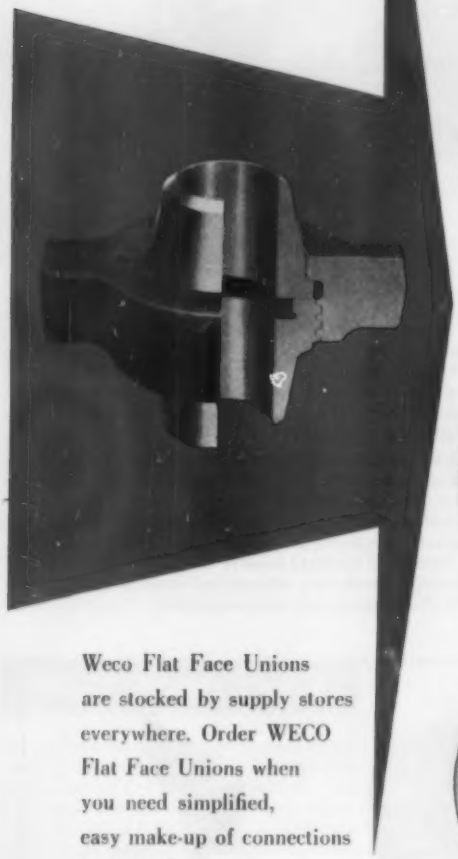
NEW WECO FLAT FACE UNION

Figure 415
and Figure 615

Sizes: 2", 3", 4"

Pressures:
4000 psi test
and 6000 psi test





Weco Flat Face Unions are stocked by supply stores everywhere. Order WECO Flat Face Unions when you need simplified, easy make-up of connections in limited space installations.

U-12-58

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

WECO

Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

fmc

MARCH

- **3** Petroleum Equipment Suppliers Association, Pacific district, annual membership meeting, Ambassador Hotel, Los Angeles.
- **9-11** Midwest Gas Association, annual meeting, Hotel Fort Des Moines, Des Moines.
- **11** Petroleum Equipment Suppliers Association, southwestern district, annual membership meeting, Shamrock Hilton Hotel, Houston.
- **13** American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section; sixth annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.
- **16-18** Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.
- **17-18** Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.
- **18** Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.
- **16-19** American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, forty-fourth annual meeting, Memorial Auditorium, Dallas.
- **19-20** New England Gas Association, annual meeting, Hotel Statler, Boston.
- **25-27** American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

APRIL

- **2-3** Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.
- **2-3** American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.
- **6-7** Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.
- **5-10** American Society of Mechanical Engineers, nuclear congress, Cleveland Auditorium, Cleveland.
- **8-10** American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.
- **14** Independent Oil Men's Association of New England, annual meeting. Hotel Statler, Boston.
- **14-16** Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.
- **15-17** National Petroleum Association, semiannual meeting, Hotel Cleveland. Cleveland.
- **15-17** American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.
- **16-17** Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.
- **19-23** American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.
- **22-24** American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.
- **22-24** Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

MR. H. S. M. BURNS,

President and Chairman of the Executive Committee of the Board of Directors, Shell Oil Company

". . . no factor is more essential . . ."

"From exploration through marketing, the success of oil industry operations depends largely on what the military men call logistics—making sure that what you want is where you want it when you want it.

"Most of us oil men in the United States take it for granted that such matters can be easily handled. Getting supplies and equipment ordinarily involves no more than reaching for the telephone. The reason is that the suppliers do such a good job of maintaining warehouses and effecting deliveries. I suspect that many of us become so used to this that we don't appreciate it properly.

"I learnt appreciation the hard way some years ago when I was involved in developing new oil fields in nearly inaccessible tropical jungle, hundreds of miles from the comforts of civilization. We surely missed being able to handle our supply problems by the phone call treatment.

"The oil industry is complex. Its future success will depend on continued performance by all its members. And no factor is more essential or more likely to contribute to that end than the vigorous, progressive companies that supply petroleum equipment."

P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

You save in many ways with TEL-O-SET transmitters

... today's most advanced pneumatic transmitters

Measure temperature, gage pressure *or* absolute pressure with the same accurate, highly responsive *Tel-O-Set* transmitter.

CUT INSTALLATION COSTS

Mount the transmitter anywhere, indoors or outdoors—it's weatherproof. Easily installed on wall, pipe or horizontal well.

CUT SPARE PARTS INVENTORY

Only one basic transmitter needed for all applications.
Adjust range without adding or changing parts.

SAVE IN MAINTENANCE

Long life inherent in rugged force-balance mechanism.
All working parts and adjustments protected by weatherproof cover.

Get complete details on *Tel-O-Set* transmitters, receivers, and controllers from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

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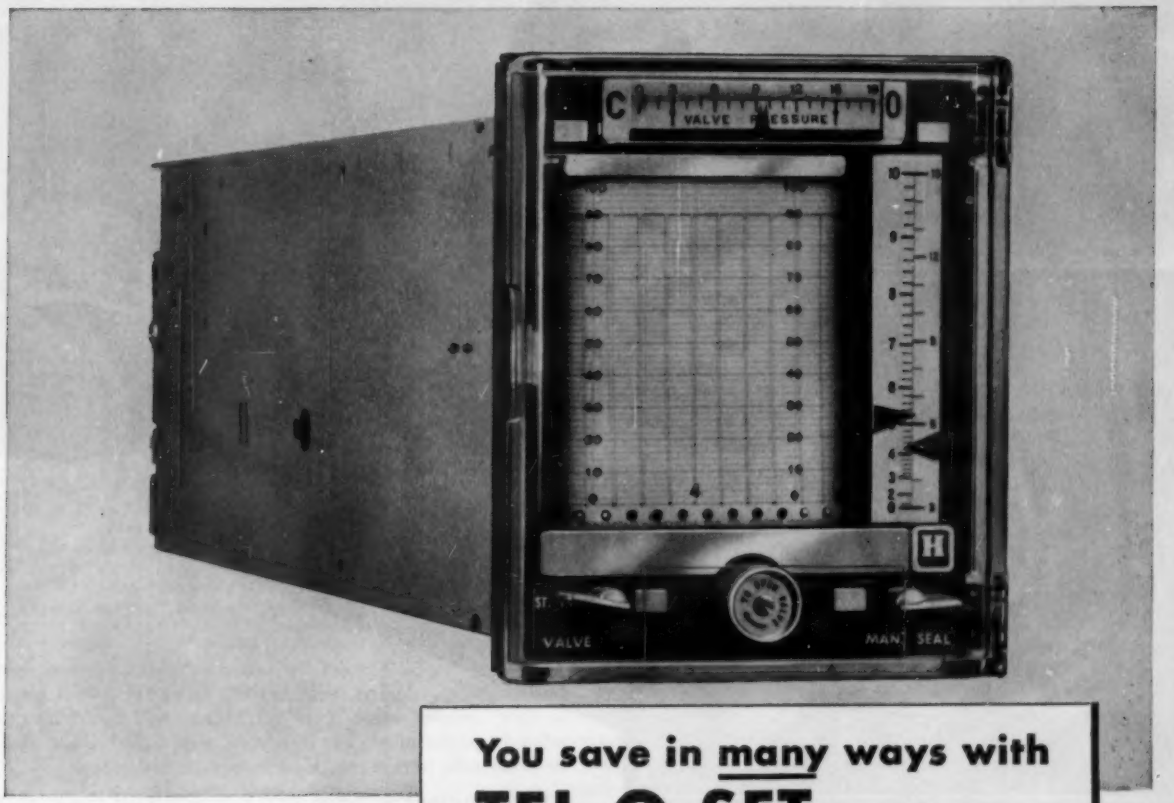
● **REFERENCE DATA: Write for Catalog C100-1A, "Tele-O-Set Indicators, Recorders, Controllers."**

H HONEYWELL *First in Control*



You save in many ways with TEL-O-SET receivers...

today's most advanced miniature pneumatic instruments

Record or indicate any process variables with versatile *Tel-O-Set* receivers. They're the most dependable, economical, and easily-serviced miniature instruments you can buy.

CUT INSTALLATION COSTS

- Startup is safeguarded by wiring and piping case separately . . . keep chassis safe in original carton until startup.
- Quick-connect design makes chassis mounting easy, fast, foolproof.

CUT SPARE PARTS INVENTORY

- Use any *Tel-O-Set* receiver with any pneumatic force-balance controller.
- Change recorder to indicator and vice versa . . . without changing case or disturbing field connections.

REDUCE PROCESS DOWNTIME

- All working parts can be inspected during operation, without process interruption.
- Zero and span, the only adjustments required, are set from front of panel.

SAVE IN MAINTENANCE

- Separate pneumatic and electric connections—no need for electrician to stand by.
- Linearity built in at factory, requires no attention.

Get complete details on receivers and other *Tel-O-Set* instruments from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Aves., Phila. 44, Pa.

Honeywell

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Craftsmanship Counts at CB&I . . .

Almost 70 years of specialization in the design, engineering, fabrication and erection of steel plate structures will build long and efficient performance life into your next CB&I-built storage or processing structure. Here's why:

CB&I Engineers From first contact with the customer through final testing, CB&I's general engineering staff supplies technical guidance to the CB&I team. Important coordination between fabricating, erection and testing of your structure is thus insured.

CB&I Fabricates The finest manufacturing facilities—including X-ray and stress relieving—backed by metallurgical laboratories and testing facilities second to none—are maintained in four strategically located and fully equipped fabricating plants.

CB&I Erects Skilled, responsible crews work with up-to-date equipment. Field X-ray and stress relieving equipment, backed by welding research laboratories, are an important part of their trade. Experience in a wide variety of metals, including stainless, nickel, aluminum and clad materials are also part of the service that has earned CB&I a *global* reputation for erecting on a *world-wide* basis.

These coordinated services are what you receive when you contract for a CB&I-built structure. CB&I customers have learned to expect and get top rated performance and maximum service life from CB&I *craftsmanship in steel.* Write our nearest office for details. Ask for the CB&I Bulletins on: *Special Plate Structures* and *CB&I Field Services.*

P73CB

1. 5-in. thick plate for reactor is fabricated at CB&I's Birmingham, Alabama plant.

2. Workman smooths seams on an assembled section.

3. X-ray machine for checking seam welds. Machines operating at 1,000,000 and 2,000,000 volts are used to completely inspect steel vessels as much as 10 inches thick.

4. 72-ton top section for reactor-regenerator is lowered into position under supervision of CB&I erection specialist.

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The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone LUther 4-4411. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

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JOURNALLY SPEAKING

Anniversary Present

HOW DOES it feel to be 100 years old—which is what the oil business is this year?

We on the Journal think it feels pretty good. And we're in position to speak because we've just finished reliving those 100 years. We relived them journalistically, and we put the results into a big book so that you, our readers, can relive them, too.

All during 1959 you'll be hearing a lot about the history of the oil industry, and you'll be asked a lot of questions. Since you haven't been around for 100 years personally, you won't be able to speak from first-hand knowledge. So we suggest that you get primed by reading our book.

We've titled it "Petroleum Panorama," and we didn't pick the name just for its alliterative qualities. A panorama is a broad, all-encompassing view, a big picture with lots of depth, perspective, and background.

And that's exactly how we looked at oil's first hundred years. The industry is so widespread geographically, and so ramified in its technical and economic aspects that we deliberately omitted details that didn't contribute much to the main story of how the industry got to be the way it is and what influenced its course during the century.

Our aim was to give oil men a rather quick account of the major events and developments, to put them in their proper setting and relationship to each other, and to point up their significance. And we're quite confident that we succeeded.

Is this just another oil history? No indeed. There will be many books and articles about oil's history published during 1959. Some of them will be by professional historians without much background in the oil business. Some will be about individual oil men or oil companies. Others will deal with particular localities or events.

But Petroleum Panorama will be different. It's an oil history for oil men by oil writers.

Our whole staff of experienced oil reporters worked on this. We did a reporting job in retrospect. Turning from our accustomed task of reporting what's happening today that may influence what will happen tomorrow, we focused our reporters' eyes on what happened yesterday that set the stage for today.

And it wasn't easy, even for us whose business it has been to write oil history as it was being made during most of our adult lives. Some of us spent the better part of a year in research—and then discarded 90% of what we had gathered in order to boil down the printed pages to the real essentials.

For instance, you're going to hear about the Drake well until you're sick and tired of it. But not in Petroleum Panorama. We give Mr. Drake a couple of paragraphs. It's not that we belittle Drake's contribution, but in perspective that's all the space he seemed to rate in comparison with all the other important things going on contemporaneously and subsequently.

We gave the same treatment to many other events which could be (and have been) the subject for an entire book. So don't look to Petroleum Panorama for the complete details on every place, event, and personality in oil's history.

Look to it for a running narrative of the really significant events—technical, economic, political—that shaped the industry's growth around the world. We've put the happenings in their proper frame of reference so you can see the chain of cause and effect throughout the 100 years.

And it's no dull, dry history, either. It's broken up into sections and short, sparkling subdivisions for easy reading and quick reference.

And it's packed with pictures, maps, and charts, all selected both for their historical interest and their significance.

Petroleum Panorama is the Journal's anniversary present to the men of the oil industry.

And how do you share in the present? Easy. Just be sure your name is on our subscription list. You'll get your copy automatically, at no extra charge, during the last week in January.

—Henry D. Ralph

no well is "completed"...

until the vital casing I.D.
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BAKER OIL TOOLS, INC. / HOUSTON / LOS ANGELES / NEW YORK

For the hundredth time

THIS New Year's week finds the oil industry in its hundredth year. Like those that have gone before, it will be a year with many uncertainties, some surprises, and the same old basic problems.

But from its century of experience the industry should be able to meet these problems more effectively than it has in prior years. It should have enough maturity to apply the advice it has given itself a hundred times.

BUSINESS WILL BE BETTER during 1959. There has been a general upswing from the economic recession. This is the basis for the pleasing forecasts of increasing demand for petroleum products.

But for the hundredth time—better business doesn't mean boom. The increase in demand will be moderate, and can be met with a moderate increase in supply spread among all sources. With its huge excess capacity, the industry could easily outpace its markets and repeat the plague of oversupply which has been chronic in most of its 100 years.

So caution and restraint should be the motto for this year—trite and unpleasant as that advice is.

Looking ahead and around, it should be obvious that while the world will require tremendous quantities of energy fuel, it has abundant supplies in sight. Every crude-producing area is competing for the markets of the others, and against other types of fuel. So it would be unrealistic to count on much of an increase in oil prices.

Profits will be better in 1959—better, that is, for those operators who can keep down their costs, learn to live with unused capacity, and meet competition in the marketplace. So efficiency and economy should get top billing, not to weather a temporary recession but as a long-range operating policy.

IT IS THE CENTENNIAL. This year oil celebrates its hundredth anniversary. It is deliberately calling attention to itself, putting itself in the public spotlight. Here is its greatest opportunity.

It will not be enough to recall the quaint early days of oil, to retell amusing anecdotes of its beginnings. Nor will it be enough to praise oil's contributions to civilization, or to dramatize the industry's technological prowess.

For 99 years the oil business has failed to make the public understand it. This is its hundredth and greatest chance to explain what it really is and how it really operates.

And the best way to do this is to demonstrate by actions that it is now a mature industry with a grasp of economics, a social conscience, and sense of public responsibility that have changed from the public's old image of it as much as its technology has changed from that of 100 years ago.

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says Mr. H. W. Stooksberry
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"Our '59 Ford often runs 24 hours a day to meet the demanding schedules of this business. We haul six types of oil well testing equipment for both offshore and onshore work, and there's always a race against time on every job.

"This portable testing equipment is a big load, and one that pulls hard on the highway. At the wellhead, we often hit especially tough going. We stick with Fords for this work because our experience shows they do the best job, and do it fast and economically."

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Whatever your job . . . wherever you do it —you'll find Ford trucks are engineered and built to do it better! Whether you need a 4-wheel drive pickup like the one shown below—or a heavy-duty tandem similar to the one used by the Stooksberry Tank Co., you'll be *ahead* with a Ford. And for '59, there are even more reasons to invest in a Ford Heavy or Extra Heavy. You'll discover:

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New Ford 4-wheel drive trucks available in ½- and ¾-ton pickup, stake and chassis-cab models. Ford-built at Ford's low prices. Available early 1959.

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...WHERE DENSE CEMENT BACK OF THE PIPE IS ESSENTIAL

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In the Gulf Coast, East Texas and similar areas, certain conditions can cause endless trouble, such as:

Contamination by oil-well fluids of fresh water sands near ground surface.

Hazards of gas seepage from high pressure gas formations to low pressure or dry sand formations.

Water leaks at the bottom of the well, causing a mixture of water and oil to come in, making necessary expensive remedial squeeze jobs.

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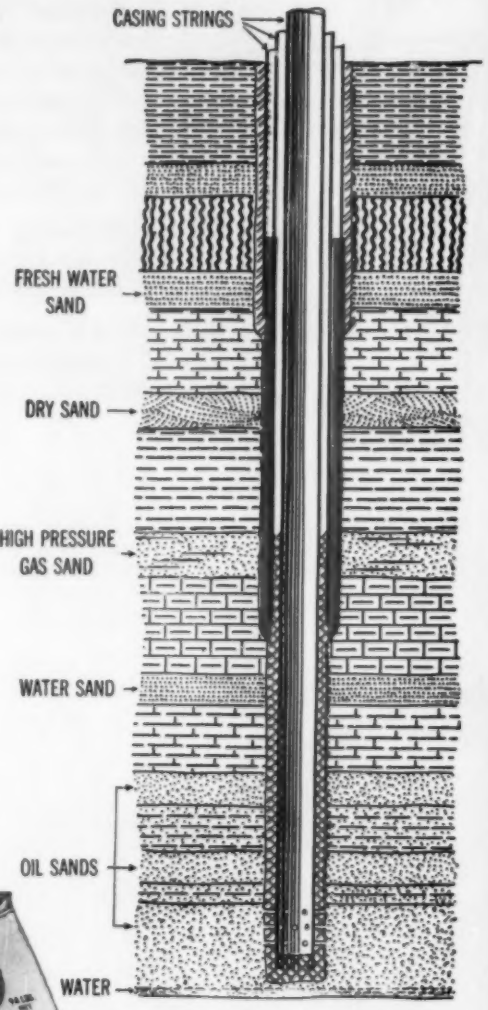

Oil well conditions typical of those encountered in the Gulf Coast, East Texas, and similar areas.

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Oil Starts '59 With Its House in Order

• All indications point to better things ahead for the industry. The year-end picture finds stocks in good shape, demand picking up, production rising.

THE OIL industry enters 1959 with all its economic barometers pointing optimistically to fairer weather for the year.

This optimism is firmly based on these conditions existing at the close of 1958:

. . . **Total petroleum demand** in December was about 900,000 bbl. daily higher than for the same period a year before with the trend rising sharply.

. . . **Stocks** of crude and the major refined products were below year-before levels and some spectacularly so.

Economists interpret this demand-stock position as the prelude to a possible increase in production and firming of crude and product prices in the new year.

And with a rise in production and improvement in prices, the cash will become available for more exploration and drilling work and other capital spending.

In a nutshell, that's why oil economists feel cheerful about the prospects for 1959.

This optimism isn't fully shared by many individual oil men, however. Some are more pessimistic, still holding fresh memories of the austerity measures which the industry was forced to take during 1958.

Year of cutbacks . . . The austerity which characterized 1958 actually laid the groundwork for oil-industry improvements in the new year.

The industry in the early part of 1958 paid for the 1957 excessive production and refinery runs which accompanied the Suez crisis. A general economic recession aggravated oil's own private depression. Crude-production cutbacks started in February and hit bottom in May before turning upward (see charts). Refinery runs hit the skids in January and fell steadily until late spring.

Excessive stocks weren't the only reason why these cutbacks were mandatory. Total petroleum demand suddenly went sour when winter ended and by March had dropped below levels of 1956 and 1957. The drop continued until May. This added to the burden of the stock excesses and threatened the price structure of products and crude alike.

The dramatic slowdown in supply, however, turned the trick. Crude stocks came down sharply and so did inventories of products, especially gasoline. Fortunately, demand also turned the corner, and the general oil-industry outlook brightened.

The second-half recovery has been spotty but generally steady. A combination of good offseason gasoline demand plus a series of December cold waves that lifted the heating trade brought the industry into a good position by the end of the year.

A better idea of what 1959 holds for the industry is gained when the present position of demand, stocks, production, and runs are examined separately.

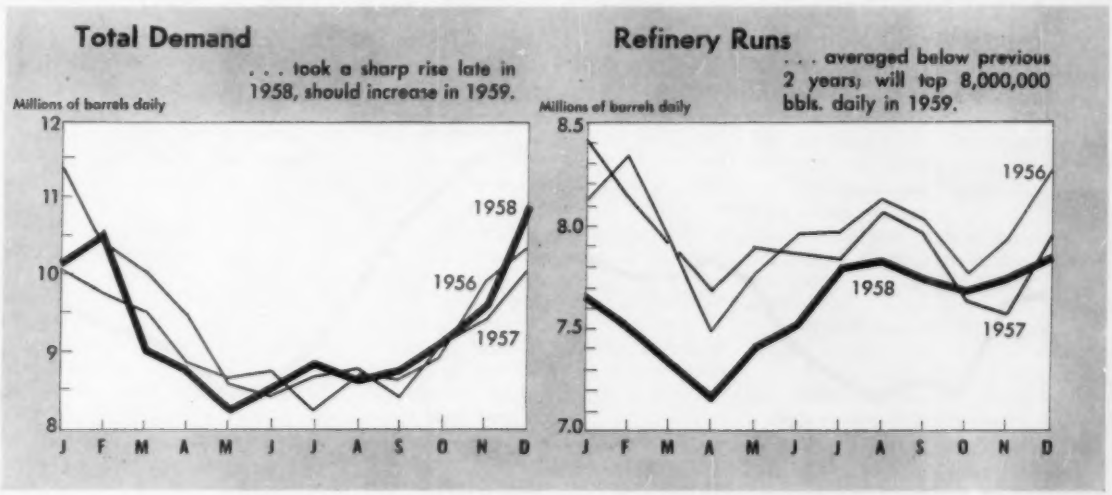
Demand . . . December's total demand ended the year on a grand note.

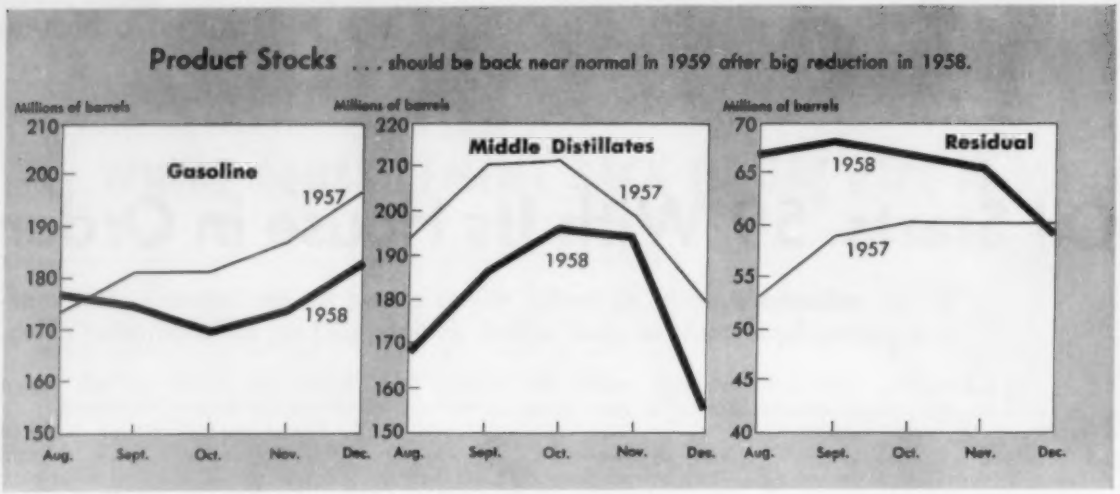
Cold weather in late November and December boomed heating oils. Demand for other products also increased to put December total demand above 10.9 million barrels daily, the highest on record for December.

Total demand ran ahead of last year for each of the last 4 months in 1958 and would have done even better except for warm weather in October and early November.

Unless the weather should turn unseasonably warm in January, the industry will mark up a very successful heating-oil season.

But also encouraging is the per-





formance of industrial fuel and gasoline.

Gasoline gained in each of the year's last three quarters over the same periods in 1957. Sales were 2% higher than 1957 in the second quarter, 2.3% higher in the third and about 3.9% higher in the final quarter.

Residual also performed well in the last half, nearly pulling even with 1957 sales in the third quarter and then going ahead by 1.2% in the last 3 months of the year.

Steadily improving business conditions expected in 1959 should boost sales of these products even more in the new year. One oil-company economist predicted in late December that domestic demand in 1959 would average 9,378,000 bbl. daily for a 4.6% gain over 1958. Consensus of others earlier in the month was for a 3.8 to 6% gain (OGJ, Dec. 22, p. 31).

Refinery runs . . . Fortunately for the industry, refiners haven't been lured by demand gains into shoving up their crude runs.

Refinery runs in 1958 trailed levels of the 2 years previously except for a couple of months in the last quarter. Sharpest cutbacks naturally were in the spring, but refiners showed restraint throughout the year and ended 1958 with runs averaging about 7,600,000 bbl. daily compared with 7,915,000 bbl. daily for 1957. The outlook for 1959 is average runs exceeding 8,000,000 bbl. daily.

Stocks . . . Chief result of throttled-down refinery runs was a dramatic decline in petroleum stocks.

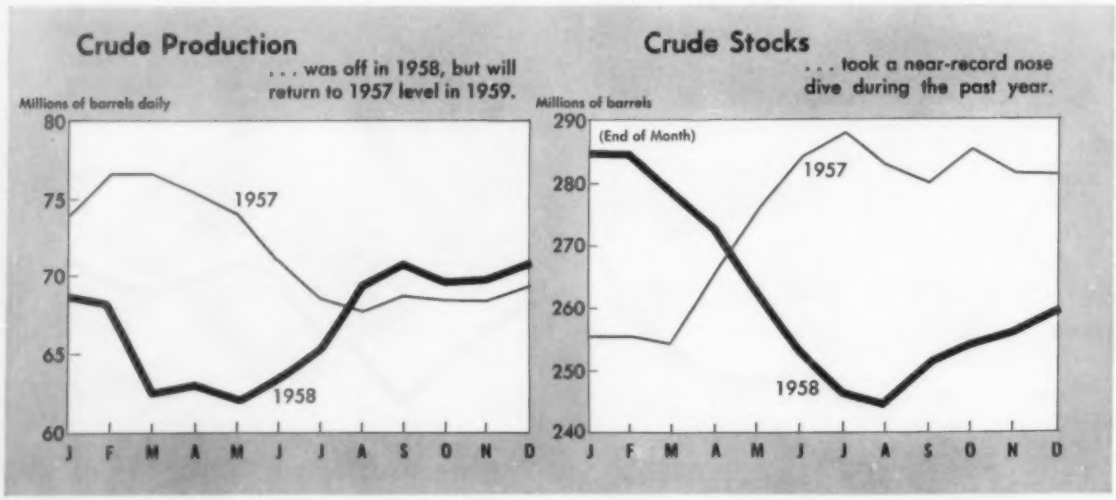
Crude stocks stood at 285 million barrels at the start of 1958. By August they had been drawn down to 245 million barrels and in the last part of the year built up only to 260 million barrels. The net drawdown for the year thus was about 25 million barrels, one of the greatest stock reductions since World War II and nearly twice as great as the Korean mobilization year of 1950.

The 1958 year-end position of gasoline and middle-distillate stocks are excellent. In each case the stocks were lower than 1957 and appeared to be nearly back to normal. Residual stocks also are running slightly below 1957.

Gasoline stocks were estimated at 183.5 million barrels at the end of 1958 compared with 196.7 million barrels in 1957. Middle-distillate stocks were about 154 million barrels compared with 178.6 million barrels in 1957; and residual totaled near 59 million barrels compared with 59.9 million barrels the year before.

Production . . . Domestic crude production was down sharply in the first 7 months of 1958.

It jumped ahead of 1957 levels in August and remained there throughout the rest of the year, winding up December at 7.1 million barrels daily, equal to the year's highest levels.


Crude Production
. . . was off in 1958, but will return to 1957 level in 1959.
Millions of barrels daily
1957
1958
Crude Stocks
. . . took a near-record nose dive during the past year.
Millions of barrels
(End of Month)
J F M A M J J A S O N D

Average production for the year is put at 6.7 million barrels daily, a 6.5% decline from 1957's 7.17 million barrels daily. Crude production is expected to recover its losses in 1959 and top 1957 record. This means an average jump of more than 500,000 bbl. daily.

Prices . . . The outlook for prices of both products and crude is good.

Distillate prices in both the Mid-Continent and Gulf Coast regions are at their highest levels since June and July 1957. This product has enjoyed two ¼-cent a gallon price increases in the Mid-Continent in December and one of the same amount on the Gulf Coast.

Residual fuel oil also moved up 10 cents a barrel in the Mid-Continent in December. The price, ranging from $1.60 to $1.80 a barrel, is still below the $2 a barrel quoted for the Gulf Coast. But the price rise reflects increased demand in industrial plants, especially in Great Lakes steel mills.

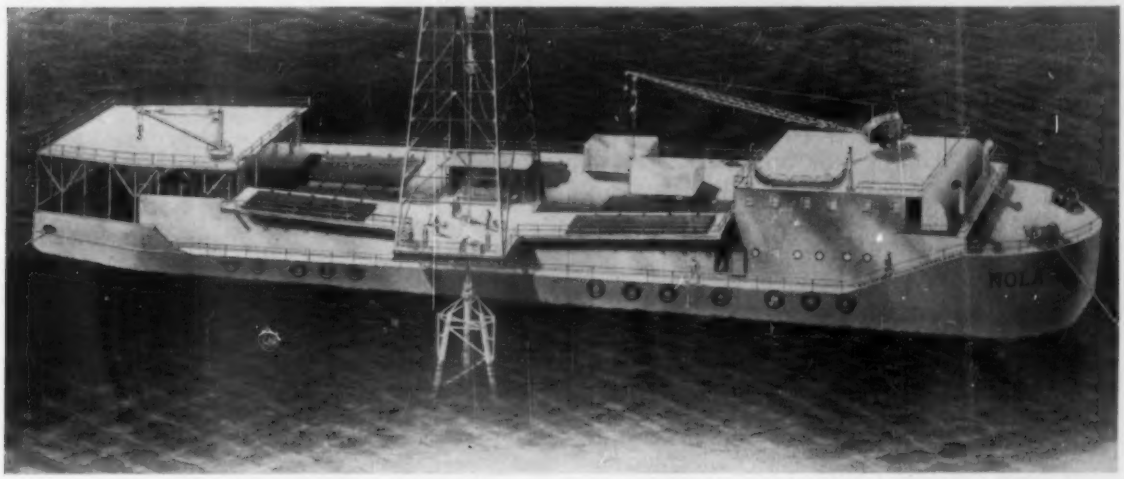
The crude price structure, meanwhile, appears to be stabilized after several months of chipping away at postings and adjustments in gravity differentials. Some changes still may be in store for such areas as Oklahoma and Kansas where crude is moving on two separate price schedules.

As for gasoline prices in the 1959 motoring season, good demand for the current winter months augurs well. Much still will depend, however, on a hatful of variables, such as how fast stocks build up in the next few months, spring weather, and general business conditions. All have a bearing on gasoline demand and prices.

A headache . . . The real problem of the oil industry for 1959 and a few years after that is learning to live with a world oversupply of petroleum.

This oversupply plus rising domestic costs is the basis for the pessimism that exists in the oil industry. All the optimistic forecasts for 1959 are based on the assumption that some sort of imports control program will be retained and that crude imports will average somewhere near 1,000,000 bbl. daily. If imports move in without effective controls, 1959 will be a sorry year for the domestic industry.

But the feeling in Washington is that some form of controls for imported oil will be hammered out. And with that assurance, oil men can view the trends in demand and petroleum inventories as signs of a good year ahead in 1959.



THE NEW NOLA 1 will feature a 15,000-ft. rig which will drill over the starboard side.

Idle Tender to Become Floating Barge

A NEW STYLE in offshore drilling equipment will make its debut shortly in the Gulf of Mexico.

Because of the deep slump in offshore drilling, Zapata Off-Shore Co. is converting its idle tender, the Nola 1, into a floating drilling barge in an effort to put it to work.

When the conversion is finished early this year, the new unit will be able to drill to 15,000 ft. in 200 ft. of water.

Zapata isn't crowing yet about its accomplishment. Not until it spuds its first offshore well will the company unveil the Nola 1 to a curious and much-interested offshore drilling industry.

But the basic information about the conversion job is told in the Houston company's annual report.

The conversion . . . The 15,000-ft. rig on the converted Nola 1 will be mounted amidships so that it drills over the starboard side.

To give stability, the company is adding a 150-ft. sponson to the port side. For additional stability in heavy seas, Zapata is adding a multiple anchor system.

Drilling will be possible in water as deep as 200 ft. Only in core drilling has a floating barge drilled in water that deep.

The rig will be a National 130 with a standard 140-ft. derrick. The tender will have full crew quarters and a heliport. Zapata is patenting a number of features on the new barge.

The advantages . . . Zapata figures its new unit will have several virtues:

. . . **It can move rapidly** from one drill site to another.

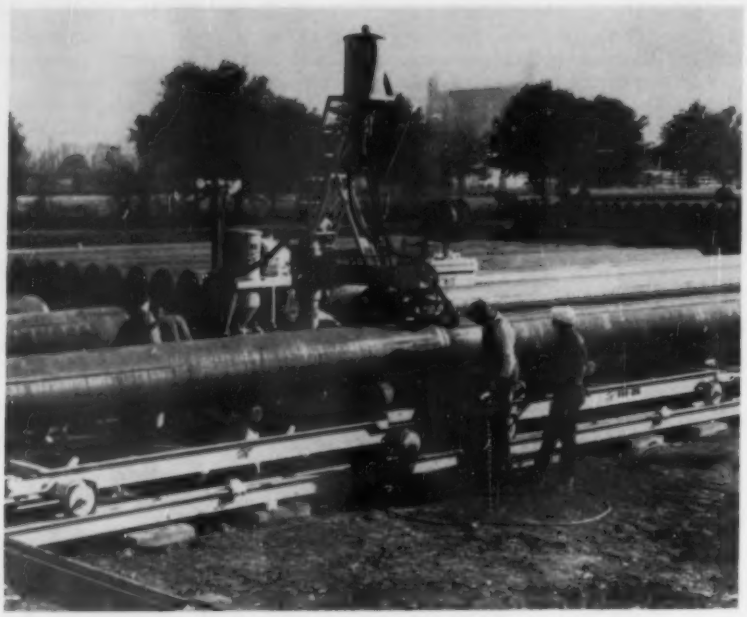
. . . **It can drill** in deep water.

. . . **As a single unit,** it can operate more cheaply than as a tender tied to a platform.

. . . **It will be able** to drill in soft-bottom areas.

. . . **It can set the drilling** or completion structure where necessary.

Nolan Stewart, formerly of Brown & Root, Inc., is overseeing the conversion for Zapata. Stewart joined the company last June.



Double Jointing Is Speeded

. . . with Bechtel's new automatic-welding equipment for field yard operations. Floating welding head is used.

A NEW automatic-welding technique is being used by Bechtel Corp. for faster and more economical double jointing of pipe for field yard operations.

Bechtel, working with equipment manufacturers, spent nearly 2 years in research and pilot-plant operation to perfect the equipment. It is now at work on 80 miles of 24-in. between Baton Rouge and Lake Charles, La. Double jointing is under a subcontract from Oklahoma Contracting Co., Dallas, which is laying the section for Coastal Transmission Corp.

The Bechtel development represents another approach to the goal of combining the economy of double jointing at a central field plant with greater portability to avoid long hauls. H. C. Price Co. last month disclosed results of shop tests on newly designed automatic-welding equipment intended for use on the pipeline right-of-way (OGJ, Dec. 29, p. 72).

Bechtel says its equipment permits a double-jointing plant to be set up where the terrain is convenient for handling and double jointing pipe. It produces welds which meet or exceed existing code requirements.

When pipe is double jointed, nearly half the welds are made manually on the right-of-way. Each time the pipe gang adds a joint, it moves forward 80 ft. instead of 40 ft. when handling single joints. So progress of the entire spread is increased, reducing construction costs, which is the reason for double jointing.

Bechtel technique . . . The new method is a step beyond the automatic-welding machine which Bechtel developed in 1947 for Trans-Arabian pipeline.

This equipment had a water-cooled backing bar which made it possible to make outside welds for triple jointing of pipe for Tapline at a marine terminal in Arabia. In the new technique a flexible Fiberglas sleeve, held firmly under the welding groove by a pneumatic internal line-up clamp, replaces the rigid water-cooled bar.

The line-up clamp is a modification of a clamp made by Perrault Equipment Co., Tulsa, which also built the rest of the equipment for the automatic-welding plant. The clamp presses expandable, full circumference, segmented backup shoes against the under side of the weld joint. The backup shoes hold the sleeve tightly against the joint to provide a smooth uniform inside contour of the weld.

The sleeve conforms to the contours of the joint even where offset and irregularities occur and allows the metal to solidify without cold laps.

Welding operation . . . Welds are made by the submerged-arc process, as in the Price method, and consistently give 100% penetration.

The weld is completed in two passes.

Irregularities in the pipe are automatically corrected as the welding head floats vertically and horizontally over the joint. A "dog-leg compensator" helps to align the pipe and relieve stress at the welding groove.

A visual check through meters on the equipment permits easy control of the welding process. Voltage, amperage, arc travel, and offset are preset to diameter, thickness, and type of material of the pipe.

Slag is removed manually during initial weldings, allowing the cover pass to be deposited without breaking the arc. The completed weld has a smooth contour because the weld metal has fused gradually into the pipe material. This characteristic minimizes notch effect and flow restrictions.

The complete weld is made in 5 to 7 minutes on large-diameter pipe. Welds meet API Standard 1104, and the procedures used qualify for both API 5L and API 5LX pipe.

Alaska Test Staked

by Halbouty and King near two discoveries at Kenai.

SPUDDING of a new Alaskan Kenai Peninsula test just 3½ miles southwest of Kenai's second producing well is set for February 1.

A 15,000-ft. drilling rig was ready to leave last weekend from Long Beach, Calif., for Seward, where it will be trucked to the drilling site.

The operation is a joint venture by Halbouty Alaska Oil Co., Houston, and King Oil Co., Wichita Falls, Tex., which hold two farmouts on Kenai from Alaska Oil & Mineral Co., New York. Halbouty is the operator, and Coastal Drilling Co. has the drilling contract.

The well will be in the northeast corner of a 2,240-acre tract, 3½ miles southwest of the 2 Swanson River Unit, a producer brought in by Standard Oil Co. of California (OGJ, Dec. 22, 1958, p. 34).

While prepared for 15,000-ft. drilling, Halbouty expects to go to 10,000 to 12,000 ft., "depending on what we find." The company will test the Hemlock zone, which holds production for the Swanson River Unit wells.

Halbouty and King each hold 50% of the farmout of the 2,240-acre tract and have a similar deal on 3,300 acres in the same capacity. Halbouty also holds another 30,000 acres on Kenai, though not as close to the discovery well.

27½% Depletion Faces Stiff Test

• There are not enough "sure" votes to guarantee present rate will remain. Senate opposition gained last session and may have new strength as Congress convenes this week. Big question is how 18 senators, mostly newcomers, feel.

THE 27½% oil and gas depletion allowance may face its greatest threat in history from the new Congress.

Because of the big turnover in the upper house, the Senate can no longer be counted on to stem the rising tide against depletion in the House of Representatives.

An analysis of past voting records and public statements shows clearly that there are not enough "sure" votes in the new Senate to save the present depletion rate. Even some of the votes that were steadfast for the industry in past years may waver with the new leftward trend in Congress.

Granted, though, that the industry has no assurance it could withstand an attack on the present depletion rate, anti-depletion forces still are not certain of their strength to change the rate. The deciding vote is held by the 18 senators, most of them newcomers, whose attitude toward depletion is not a matter of public record.

But this is not especially consoling to the oil industry, for of the 16 new senators 13 are Democrats and only 3 are Republicans. The vote on depletion does not follow party lines, but sentiment against the depletion provision has been much stronger in the Democratic column than in the Republican.

Last August, when depletion withstood its last attack in the Senate, 23 Democrats and 11 Republicans favored the Proxmire amendment calling for a graduated cut. Thirty-six Republicans and only 23 Democrats were on record against the amendment.

Further evidence of the Democratic opposition to the depletion rate is the fact that 14 of the 18 Democratic newcomers in the last Senate were on record for the Proxmire amendment.

Sen. William Proxmire (D., Wisc.), architect of the graduated scale, has announced plans to renew his anti-depletion campaign after Congress convenes January 7. According to rumors circulating in Washington, he apparently thinks he has enough support to succeed this time.

If depletion can not withstand an attack in the Senate, it is given practically no chance to survive in the House. Since the depletion question came to a vote only in the Senate last year, relatively few members of the House are on record for or against the present depletion rate. But the House, traditionally less conservative than the Senate and more responsive to changing political winds, is certainly not the best battleground for defending depletion.

Past votes . . . The Senate itself has shifted its sentiment in recent years. How far the shift has been is still a question mark.

The depletion allowance was written into law in 1926. Since that time, the 27½% rate has remained constant.

For many years the rate went almost unchallenged in Congress. Most of the opposition has come in the past decade. But never, until this year, has the rate appeared in much imminent danger.

As recently as 1951 the 27½% rate was upheld by the Senate 71 to 9. That was the last roll-call vote on the question by the Senate until last August's sudden uprising.

Even the 1958 vote did not seem to place depletion in immediate jeopardy. The Senate voted 63 to 26 against a proposal by Sen. John J. Williams (R., Del.) to reduce the rate to 15%.

Then came the Proxmire compromise. He proposed retaining the 27½% rate for oil and gas producers with gross income of $1 million or less per year. But he tried to cut it to 21% for producers grossing from $1 million to $5 million and to 15% for those grossing more than $5 million.

The Proxmire amendment was defeated by only 31 to 58.

Actual sentiment was a little more in favor of the proposal than the vote would indicate. Sen. Thomas C. Hennings, Jr., (D., Mo.), Sen. Estes Kefauver (D., Tenn.), and Sen. Frederick G. Payne (R., Me.) indicated they would have voted for a lower rate if they had been present. Only one non-voting senator, S. L. Holland (D., Fla.), went on record against Proxmire.

Of these four, Payne is the only one missing from the 1959 lineup. Taking into account the sentiment expressed but not voted, leaves an indicated vote of 59 to 34 in favor of the existing depletion rate. However, Sen. John W. Bricker (R., Ohio), who has since been defeated, voted for the across-the-board cut but not the graduated cut.

That brings last year's indicated total to 35 against the 27½% rate, 58 for it, and 3 doubtful.

Present outlook . . . As the accompanying table shows, the 1958 elections changed the outlook drastically.

Only 47 senators who were on record for the 27½% rate last August will be back in 1959. One newcomer, Alaska's E. L. Bartlett, has taken a stand for 27½% depletion. That leaves pro-depletion forces two votes shy of a majority in the new Senate, which will have 98 members with the admission of Alaska as a state.

In other words, depletion as it exists today apparently lost 10 relatively sure votes. On the other hand, indications are that the anti-depletion forces lost only three net votes.

The accompanying table lists as opposed to the 27½% rate any returning senator who voted for either the Williams or the Proxmire amendments last August. Also listed as opposed is Senator-elect Ernest Gruening (D-Alaska). He has spoken both for and against the present depletion rate since his election to Congress. His wavering indicates he is opposed, to some degree, to the present rate.

Sen.-elect Stephen Young (D., Ohio) also is listed in opposition to the

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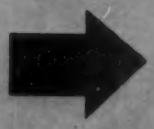
Here's How the New Senate Stands on 27½% Depletion



Indicated

Indicated

	Indicated Sentiment on 27½% Rate		
	For	Against	?
Alabama			
John Sparkman (D)	X		
Lister Hill (D)	X		
Alaska			
E. L. Bartlett (D)	X		
Ernest Gruening (D)		X	
Arizona			
Carl Hayden (D)	X		
Barry Goldwater (R)	X		
Arkansas			
John McClellan (D)	X		
J. W. Fulbright (D)	X		
California			
Thomas Kuchel (R)	X		
Clair Engle (D)			X
Colorado			
Gordon Allott (R)	X		
John Carroll (D)		X	
Connecticut			
Prescott Bush (R)	X		
Thomas Dodd (D)			X
Delaware			
John Williams (R)		X	
J. Allen Frear (D)	X		
Florida			
S. L. Holland (D)	X		
George Smathers (D)	X		
Georgia			
Richard Russell (D)			X
Herman Talmadge (D)	X		
Idaho			
Henry Dworshak (R)	X		
Frank Church (D)		X	
Illinois		X	
Paul Douglas (D)			
Everett Dirksen (R)	X		

	Indicated Sentiment on 27½% Rate		
	For	Against	?
Indiana			
Homer Capehart (R)	X		
R. Vance Hartke (D)			X
Iowa			
B. B. Hickenlooper (R)	X		
Thomas Martin (R)	X		
Kansas			
Andrew Schoeppel (R)	X		
Frank Carlson (R)	X		
Kentucky			
John Cooper (R)	X		
T. B. Morton (R)	X		
Louisiana			
Allen J. Ellender (D)	X		
Russell B. Long (D)	X		
Maine			
Margaret Smith (R)		X	
Edmund Muskie (D)			X
Maryland			
John Butler (R)	X		
J. Glenn Beall (R)	X		
Massachusetts			
Leverett Saltonstall (R)	X		
John Kennedy (D)		X	
Michigan			
Patrick McNamara (D)		X	
Phillip Hart (D)			X
Minnesota			
Hubert Humphrey (D)		X	
Eugene McCarthy (D)			X
Mississippi			
James Eastland (D)	X		
John Stennis (D)	X		
Missouri			
Thomas Hennings, Jr. (D)		X	
Stuart Symington (D)		X	

present depletion rate before taking his seat in the Senate. As a member of the House ways and means committee, he once voted for cutting the allowance to 15%.

In a recent press conference, Sen. Young reiterated his opposition to the existing law. He still favors cutting the depletion rate, but perhaps even below the 15% he supported in the House.

Young won a surprise victory last November over his veteran Republican opponent, Sen. John W. Bricker. But his election does not represent a decisive gain for the anti-depletion group. His predecessor was basically against the 27½% allowance, although he voted against the Williams amendment last summer.

Those who switch . . . Those who are only part-time supporters of the depletion allowance represent a special threat to the oil industry.

Their vote switching illustrates the wavering opposition to a depletion cut. They cannot be counted on to uphold the present provision if a rate reduction is wrapped in a package that appeals to them personally.

In this "wavering" category are the six senators who voted against a straight cut in the depletion allowance but were in favor of a graduated cut which hit the big companies hardest.

They are John Carroll, of Colorado; Paul Douglas, of Illinois; John Kennedy, of Massachusetts; Mike Mansfield, of Montana; Everett Jordan, of North Carolina; and Joseph O'Mahoney, of Wyoming. All of them, incidentally, are Democrats. More im-

	For	Against	? ?
Stand Today →	48	32	18
Stand or Vote in August →	58	35	3

	Indicated Sentiment on 27½% Rate		
	For	Against	?
Montana			
James Murray (D)			X
Mike Mansfield (D)		X	
Nebraska			
Carl T. Curtis (R)	X		
Roman L. Hruska (R)	X		
Nevada			
Alan Bible (D)	X		
Howard Cannon (D)			X
New Hampshire			
Styles Bridges (R)	X		
Norris Cotton (R)	X		
New Jersey			
Clifford Case (R)		X	
H. A. Williams, Jr. (D)			X
New Mexico			
Dennis Chavez (D)			X
Clinton Anderson (D)	X		
New York			
Jacob Javits (R)		X	
Kenneth Keating (R)			X
North Carolina			
Sam Ervin, Jr. (D)		X	
B. Everett Jordan (D)		X	
North Dakota			
William Langer (R)		X	
Milton Young (R)	X		
Ohio			
Frank Lausche (D)		X	
Stephen Young (D)		X	
Oklahoma			
Robert Kerr (D)	X		
A. S. Monroney (D)	X		
Oregon			
Wayne Morse (D)		X	
Richard Neuberger (D)		X	

	Indicated Sentiment on 27½% Rate		
	For	Against	?
Pennsylvania			
Joseph Clark (D)		X	
Hugh Scott (R)			X
Rhode Island			
Theodore Green (D)		X	
John Pastore (D)		X	
South Carolina			
Strom Thurmond (D)	X		
Olin Johnston (D)	X		
South Dakota			
Karl Mundt (R)	X		
Francis Case (R)	X		
Tennessee			
Estes Kefauver (D)		X	
Albert Gore (D)		X	
Texas			
Lyndon Johnson (D)	X		
Ralph Yarborough (D)	X		
Utah			
Wallace Bennett (R)	X		
Frank E. Moss (D)			X
Vermont			
George Aiken (R)		X	
Winston Prouty (R)			X
Virginia			
Harry Byrd (D)	X		
A. Willis Robertson (D)	X		
Washington			
Warren Magnuson (D)		X	
Henry Jackson (D)		X	
West Virginia			
Robert Byrd (D)			X
Jennings Randolph (D)			X
Wisconsin			
Alexander Wiley (R)		X	
William Proxmire (D)		X	
Wyoming			
Joseph O'Mahoney (D)		X	
Gale McGee (D)			X

portant, all are still in the Senate.

The foreign angle . . . The most vulnerable aspect of the depletion allowance probably is its application to foreign production.

Some of the previously staunch supporters of depletion, especially those from producing states, might be tempted to "compromise" if it would hit only the large international operators and if it would reduce the advantage of foreign oil over domestic oil. But such a tidy little bundle, as appealing as it might be to some congressmen from producing states, could wreck the depletion principle.

The House ways and means committee probably will remain the first bulwark against a depletion cut. Most of the retiring members of the committee are from consuming states. The new committee, though more heavily Democratic than in the last Congress, is expected generally to support the depletion views of Speaker Sam Rayburn of Texas.

Yet there has been speculation that Committee Chairman Wilbur D. Mills (D., Ark.) might lean toward a cut in the foreign depletion rate. A friendly committee, especially in the House where tax bills originate, can discourage attacks on depletion. But a floor fight can develop in either house when a tax bill is up for consideration, as was indicated last summer on the Proxmire issue.

There is some doubt whether depletion has the support to survive this session. If it does survive, it will face a continued threat in the future.

Economy-Car Sales Climbing in U. S.

• Auto leaders eyeing field. Effect on oil is considered slight.

ODDS ARE heavy that General Motors, Ford, and Chrysler will enter the economy car field by this time next year.

Principal reason is that the small cars are taking too big a slice of the U. S. passenger car market to be ignored much longer by the Big Three.

It's also a good bet the Big Three entries will more closely resemble the Rambler and Lark—designed for U. S. highways—than any European cars, which are built for short trips and town driving. The Rambler is the best seller in the economy field. And the Lark's popularity is forcing a step up in production.

The big question for oil: What effect will this development have on gasoline quality and volume? The answer: Little, if any, for some time.

While foreign and domestic economy cars have made a big enough inroad in the new car market to make Detroit look at its hole card, their number is still too small to be significant for oil.

The number of small cars in the U. S. is estimated at less than 1,000,000. That's less than 2% of the 54,000,000 autos in this country.

Also, about 60% of the economy autos are second cars. They may be adding slightly to gasoline consumption by more than offsetting any loss caused by motorists who have switched completely to the small cars.

Year of decision . . . With the recession behind and initial sales indicating a good year ahead, 1959 will be a fair test of whether enough of the American motoring public prefers economy over bulk, power, and speed to warrant a Detroit jump into the small-car market.

Most signs point to a continued place in the U. S. market for economy cars.

The public is in more of a buying mood than a year ago, but emphasis is still on economy. Additional gas mileage still has an appeal for a large number of motorists. That would be stimulated by an increase in the federal gasoline tax. And Treasury Department sources have disclosed that President Eisenhower plans to ask the new congress next month to boost the present 3-cent tax. Washington speculation is that the request will be for a jump to 4½ cents a gallon.

Here's a Look at Car Sales

(First 10 Months)

1957			1958		
Rank	Car	Total	Rank	Car	Total
1.	Ford	1,258,257	1.	Chevrolet	1,035,023
2.	Chevrolet	1,207,483	2.	Ford	806,524
3.	Plymouth	520,947	3.	Plymouth	330,166
4.	Buick	331,033	4.	Oldsmobile	248,818
5.	Oldsmobile	310,285	5.	Buick	208,944
6.	Pontiac	272,865	6.	Pontiac	183,324
7.	Mercury	231,896	7.	**RAMBLER**	**141,001**
8.	Dodge	224,372	8.	Mercury	114,722
9.	Cadillac	118,404	9.	Dodge	112,979
10.	Chrysler	91,362	10.	Cadillac	101,833
11.	DeSoto	89,595	11.	Chrysler	50,329
12.	**RAMBLER**	**86,065**	12.	DeSoto	40,741
13.	Studebaker	52,857	13.	Studebaker	32,665
14.	Lincoln	30,419	14.	Edsel	30,519
15.	Imperial	28,438	15.	Lincoln	22,029
16.	Edsel	15,670	16.	Imperial	12,209
17.	Metropolitan	10,090	17.	Metropolitan	10,403
18.	Packard	4,762	18.	Packard	2,429
	*Miscellaneous	158,645		*Miscellaneous	293,147
TOTALS		5,043,345			3,777,851

*Mostly foreign.

SOURCE: Automotive News.

Latest available registration figures also are favorable to the economy-car picture.

In October, American Motors sales represented 6.19% of the U.S. market. Sales of miscellaneous cars—almost entirely foreign—made up 11.55%. That adds up to 17.74%—compared with 22.3% for Ford and 21.59% for Chevrolet.

During that month, American Motor's Rambler was the fifth selling U. S. car, topped only by Ford, Chevrolet, Plymouth, and Buick in that order. In the same month a year ago, Rambler was in thirteenth place. Ranked twelfth among U. S. cars for the first 10 months of 1957, Rambler climbed to seventh for the same period in 1958 (OGJ, Newsletter, Dec. 22).

Economy cars, which grabbed off 4.8% of the U. S. passenger car market during the first 10 months of 1957, increased their share to 11.5% during the comparable period this year.

The Lark, introduced November 14, has spurred Studebaker's sales to the highest level of any previous 30-day period since 1955—the best year for all cars. Studebaker already has turned out about 31,500 Larks and Hawks (sports model). Production schedules, set at 54 cars an hour on a 40-hour-week basis, later were increased to 60 cars an hour in a 53-hour week. A jump to 70 units an hour with continued overtime operations was scheduled December 29.

Sales of imported cars are expected to top 350,000 in 1958. The year's total could hit 366,000 cars—a 75% increase over 1957. This is in contrast to an indicated drop of about 23% in 1958 sales of U. S. cars from last year.

Looking ahead, American Motors claims it will sell 150,000 Ramblers in the first half of its current fiscal year—a 100% jump from the same 6 months of the preceding year. Volkswagen, best seller of the imports, with about 60,000 cars in the U. S. this year, is shooting for a 35% increase in 1959 sales. Sales of domestic cars are expected to be up only 20 to 25%.

Costly move . . . It still isn't an easy decision for the Big Three.

Bringing out a totally new car adds up to a $300-million stake—from $150 to $200 million for design, engineering, and tooling, and another $100 to $150 million for distribution, advertising, and sales promotion.

All of the Big Three admit they have experimented with compact cars. Ford and General Motors are said to have completed prototypes.

Here's what to expect if Detroit takes the plunge into the economy car field:

First Big Three entry probably will have about 100 hp., cost around $2,000, and have a wheelbase of not much more than 100 in. It will have a six-cylinder engine with a compression ratio in the range of the Rambler American's 8.0:1, the Lark's 8.3:1, or the Rambler Rebel's 8.7:1. It will operate on regular-grade gasoline.

The Big Three's entry into the field would add competition to the field which already includes 72 manufacturers of 199 models of European cars. About half of the foreign cars have four-cylinder engines. A fourth have six cylinders. They range in compression ratio from the German Goggomobil's 6.0:1 to the Italian Maserati's 12.0:1.

FPC Approves CIG Refund

THE FEDERAL Power Commission last week approved the settlement of three rate disputes involving Colorado Interstate Gas Co.

The agreement calls for refund by Colorado Interstate of $38,540,767 to 10 wholesale customers in Colorado, Wyoming, and New Mexico and 2 interstate pipeline companies (OGJ, Dec. 29, p. 80).

Refunds will include $33,326,525 collected under three disputed rate increases dating as far back as January 1, 1954. Colorado Interstate also is required to pay $5,214,242 in interest on excess collections.

A fourth rate increase amounting to more than $2,500,000 annually, is not covered by the settlement.

Baker Named to AAODC Post

. . . to succeed Brad Mills. Association to step up statistics and membership programs, count and locate all U. S. rigs.

THE AMERICAN Association of Oil Well Drilling Contractors plans to strengthen its voice in industry and public affairs and take a more active role in legislative issues.

The association has appointed Warren L. Baker of Houston as executive vice president at the Dallas headquarters, effective January 1.

Baker is replacing Brad Mills, executive vice president since AAODC started in 1941, who is retiring.

Baker is resigning as editorial director of Gulf Publishing Co. magazines.

A native Tulsan, he has written for oil publications since 1923, has been a director of Gulf Publishing since 1939, and a vice president since 1955.

Joe Zeppa, AAODC president and head of Delta Drilling Co., Tyler, told the Journal last week the association hopes, through Baker's appointment, to greatly strengthen its program—especially in the statistical and membership fields.

One of Baker's prime tasks will be to develop solid statistics on available rigs in this country, the size and condition of these rigs, and where they're located.

The association first will approach contractors and other firms operating rigs to compile basic data on the rig situation at present.

Baker will set up a system so suppliers will report data regularly to the association on new rigs sold, old ones taken in trade and junked or resold. Rig operators will be asked to report similarly when they buy, trade, sell, or junk rigs.

Warren L. Baker

Baker also will attempt to develop statistics on wages and working conditions, prevailing in drilling areas, Zeppa said. Baker's talent, experience, and industry contacts should prove valuable in presenting the contractor's problems to his customers as well as in furthering AAODC's top aim of getting all contractors to join AAODC.

the JOURNAL *said . . .*

50 years ago

January 6, 1909

T. N. Barnsdall and several other ITIO directors were defeated for re-election to the board, chiefly because they favored piping up to one million cubic feet of gas daily to supply the city of St. Louis. Other ITIO officials opposed the move, saying gas should be kept in Oklahoma to attract new industry.

Andrew W., R. B., and W. L. Mellon of Pittsburgh, with C. H. Markham of Gulf as guide, toured operations at Mooringsport, La., Beaumont, and Glenn Pool.

Reports from Washington hint that Congress, in revising tariffs in line with criticism of Standard Oil Co., may do away with countervailing duty on petroleum products. This would open U. S. markets to a flood of Russian oil, says a Washington correspondent. While aimed at Standard Oil, change would affect all producers, he said.

25 years ago

January 4, 1934

A severe attack on the NRA marketing and pool agreements affecting the oil industry is made by Senator Borah of Idaho. He charges IPAA and NPA do not have welfare of independents at heart in supporting these government-sponsored stabilization codes. Wirt Franklin, IPAA head, calls statement false.

Axtell J. Byles, API president, calls for federal regulation, but not federal operation of the oil industry, to solve the over-production problem.

U. S. Bureau of Standards experiments with use of two gasolines for each car, one ultravolatile fuel for starting and another for operation.

Doctors attending John D. Rockefeller, Sr., convalescing from a serious illness, guard against a setback by not permitting his golf partners to visit him.

10 years ago

January 6, 1949.

Higher taxes will stifle expansion of the oil industry, John F. Seal of Socony-Vacuum advises Congressional committee.

Preliminary estimates indicate U. S. crude production in 1948 passed 2 billion barrels, the highest in history. Sales of LPG rose nearly 30% in 1948.

Excessive secrecy, not dictated by national security, rather than lack of a hope-of-profit motive, is retarding industrial use of atomic energy, the U. S. Atomic Energy Commission is advised by industrial advisory group headed by Bruce K. Brown, Standard Oil Co. (Ind.)

Louisiana State Mineral Board advertises for bids on offshore tracts, despite the U. S. Department of Justice suit declaring the federal Government's "paramount rights" to tidelands oil fields and offshore lands.

Gulf Coast Gas Ready for England

• Constock's "Methane Pioneer" will leave the Gulf Coast this month with the first ocean cargo of liquefied natural gas. If successful, this initial effort could have a tremendous impact on the world's petroleum industry.

SOMETIME this month the first cargo of liquefied natural gas will start on a historic trip from the United States to England.

World-wide interest has been aroused in the voyage during the long period required to convert a cargo ship into a heavily insulated tanker, train a crew, and give the vessel shakedown runs.

The converted freighter, "Methane Pioneer," is now making ready to take on a load of liquefied gas near Lake Charles, La., and is scheduled to sail from Port Charles later this month.

The voyage will answer one big question: Can a ship successfully and safely move gas in liquid form at the extreme temperature of minus 250° F. on a long overseas voyage?

If the trip proves a success, energy experts say it would be the most revolutionary development in the next 10 years. It would open up vast new sources of energy and create a profitable new branch of the petroleum industry.

Studies made prior to the first voyage of "Methane Pioneer" indicate:

. . . **Liquefied gas can be delivered** in Europe cheaper than manufactured gas and to the northeastern U. S. coast in direct competition with pipeline gas.

. . . **Sources of supply** in the Caribbean, North Africa, and the Middle East are ample for a high-volume movement of gas.

. . . **Vast markets** for liquefied gas exist in Europe, Japan, and even the United States.

The cargo . . . Voyage of the "Methane Pioneer" is being called one of the historic trips of modern times.

The cargo will be 33,000 bbl. of liquefied methane. This is the equivalent of 115 million cubic feet of natural gas.

Engineers estimate the delivered price of this gas as it enters the London gas distribution grid will be less than one-third the wholesale cost of manufactured gas now being used in the area.

Preliminary estimates show this data: Gas can be purchased in South Louisiana, liquefied, loaded into ship, and discharged at the Regent Oil Co. jetty at Canvey Island, for 35 to 50 cents per M.c.f.

This compares with $1.61 per M.c.f. for manufactured gas delivered at the same point.

Plenty of "bugs" . . . Work on the project started in 1955.

For the past 3 years Constock has concentrated primarily on working the "bugs" out of the process.

The liquefaction equipment, barge-mounted for mobility, is similar to liquid-oxygen units used for years. The gas is alternately compressed, cooled, and expanded across a turbine to chill it to the extreme low temperatures necessary for liquefaction.

One of the ingenious features of the plant is the direct-coupled steam turbine and expander turbine. The expander turbine takes work from the compressed gas to increase the efficiency of the cooling cycle. In so doing, it supplies about 1,200 hp. used in compressing the gas.

The biggest "bug" that had to be overcome was insulating the cargo container. Because the gas must be stored at a temperature of minus 250° F. during shipment, ordinary steel would not contain it.

The solution, developed through trial and error, was a 12-in. thick laminated balsa-wood liner which is in contact with the low temperature fluid. As the methane seeps through the wood fibers, it forms minute gas bubbles which provide an excellent barrier to heat transfer.

This wood container is inside an aluminum tank which can temporarily withstand cold spots in case of a rupture or crack in the insulation.

The aluminum tanks are enclosed in steel jackets. Five of the tanks have been installed on the modified cargo freighter.

Few doubts . . . Actually, there is little doubt that this historic voyage will succeed.

The ship has made repeated trial runs into the Gulf which were successful, and engineers already are considering the merits of supersized liquid gas tankers.

One of the owners also reportedly is negotiating in New York for a $25-million liquefaction plant in Venezuela.

The voyage . . . The "Methane Pioneer" actually will be a proving ground for the technology and economics of moving liquefied natural gas in bulk in a seagoing craft.

Basic technology of liquefying lighter gases is not new. Liquid air has been a commercial product for years. Liquid petroleum gas—its manufacture, transportation, and storage—has become a major business. LPG even has been moved by barge and ocean-going vessels.

Liquefaction plants for natural gas also have been operated successfully in the United States and Russia, the latter commercially since 1954. Explosion of a storage vessel at Cleve-

The Economic Outlook for Liquefied Natural Gas

(Prices in U. S. cents per M.c.f.)

Source and destination—	Gas price at source	Cost of processing, shipping, storage	Delivered cost	Volumes moved	Investment required— Total in million $	Investment required— Dollars per M.c.f. year
Middle East—London	3.5	47 to 54.5	50.5 to 58	.....	...	....
Caribbean—London	17.4	46.6 to 53.6	64 to 71	146,000	350	2.40
Venezuela—London	4 to 25	26	30 to 51	146,000	239	1.64
Venezuela—New York	4 to 25	21	25 to 46	146,000	220	1.50
Sahara—Marseilles	12	31 to 35	43 to 47	200,000	*466	2.33

*Includes cost of pipeline.

SOURCE: International Energy Reports.

land in 1944 ended the American venture.

Since then new materials have become available, and the "Methane Pioneer" project will test these metals and insulation for storage tanks both on the ship and at loading and receiving points, fabrication methods, ship design and operation.

The experiment is a joint effort of the British Gas Council and Constock Liquid Methane Corp., a firm owned by Continental Oil Co. and Chicago Stockyards Co.

Economics of LNG . . . Indicative of the world-wide interest in the "Methane Pioneer" are the numerous economic studies being made of liquefied natural gas.

All the studies show one fact: Overall economics of importing liquefied natural gas are extremely attractive (see table).

They also point up several other factors. Initial capital investment in tankers, processing equipment, and shore installation will be high. This means fixed costs also will be high, and a very high rate of operation is essential.

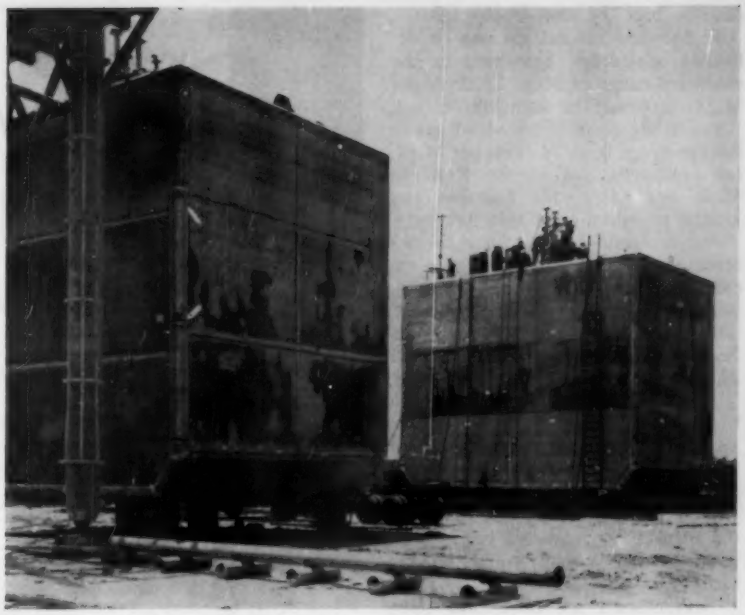
John D. Balcomb, managing editor of International Energy Reports, in a special study soon to be released of all the literature on liquefied natural gas, says all the estimates are extremely tentative.

All have been worked out before any trial shipments. They are not strictly comparable with one another because amortization bases differ and in some cases precise costs are not detailed. However, they give general cost limits and show liquefied natural gas will be very competitive with manufactured gas costing $1 and up per M.c.f. in Europe.

Investments . . . Biggest investment required in transoceanic movement of liquefied natural gas will go for transportation facilities.

One estimate of Venezuela-to-London movement puts plant cost at 41.5% of total investment and transportation facilities at 49.5%. Another estimating investment for movement from Caribbean to London puts transportation at 63 to 68% and plant and storage at 32 to 37%. Both estimates were for a base load of 146,000 M.M.c.f. per year and 100% demand factor.

Estimated net costs of processing, shipping, and storage range from 21 to 64 cents per M.c.f. This is exclusive of price of gas at the well. One study estimates cost of getting gas from Venezuela to London at 26 cents per M.c.f. Another figures the cost of movement from Caribbean to London at 53 cents per M.c.f.



INNER TANKS of aluminum are shown being welded for installation in the hold of the "Methane Pioneer." They will have a liner of balsa wood and an outer jacket of steel to keep liquefied methane at a temperature of minus 250° F. during a voyage from Louisiana to England.

Balcomb reports estimates of processing, shipping, and storage costs fall into these ranges: Venezuela-New York, 21 to 48 cents per M.c.f.; Venezuela-North Sea, 26 to 53 cents; Gulf Coast-New York, 22 to 49 cents; Gulf Coast-London, 27 to 54 cents; Persian Gulf-North Sea, 37 to 64 cents; Sahara to Marseilles, 31 to 42 cents; and Sahara to English Channel points, 35 to 45 cents.

Many of these costs may be trimmed when technology and experience of operation improves. There also is a possibility the cost of imported gas might be reduced by the recovery of refrigeration during regasification.

One source estimates that refrigeration recovered could be used to produce cheap liquid oxygen and provide a saving of 11.67 cents per M.c.f. French engineers estimate value of refrigeration recovered at about 5% of total cost.

Price of gas . . . This is the most difficult cost item to estimate.

The Economic Commission for Europe estimates that well over one trillion cubic feet of natural gas is being flared annually in Venezuela and the Middle East. This is about equal to the entire annual gas production from all sources in Europe outside Russia.

But this fact doesn't mean that the gas can be picked up for nothing. Price of the gas likely will be determined by competitive bidding. Experience in the United States shows that where an expending market exists, the wellhead price of gas tends to rise steadily.

Estimates of wellhead cost of natural gas for liquefaction so far have ranged from 3.5 to 25 cents per M.c.f. At this stage, it's a good guess that importers of Venezuelan gas will have to pay a price about equal to that paid in U. S. fields most distant from market centers. This would put Venezuelan prices in the 12-cent per M.c.f. range paid for West Texas-Southeast New Mexico gas. That exact figure was used by the French in estimating costs of Sahara-Marseilles movement.

Shipping costs for other more distant areas might force the wellhead price lower there.

In fact, two predictions seem certain if the "Methane Pioneer" makes a successful voyage and demand for gas increases: Wellhead prices asked by producers will go up. Price will be highest in areas most accessible to market.

Students of the question believe ample sources of gas will be available for large-scale overseas shipments from the U. S., Canada, Venezuela, Mexico, North Africa, and the Middle East.

The market . . . Europe looms as the prime market to supply an approaching energy deficit in these highly industralized areas.

But other markets are believed available in Japan and even the north-

eastern part of the United States.

If liquefied natural gas can be delivered to Europe anywhere in the estimated range of 30 to 71 cents per M.c.f. it would be competitive fuel.

Prevailing costs of base-load gas in Europe range from 76 cents per M.c.f. for coke-oven gas in the Ruhr to $1.34 per M.c.f. for Lorraine and United Kingdom coke-oven gas.

Net domestic demand for manufactured gas in western Europe now exceeds 417,000 M.M.c.f. annually. Some sources estimate the potential western European market for liquefied natural gas imports at almost 3 trillion cubic feet annually by 1975.

Japan, the most promising potential LNG market next to Europe, probably would use 900,000 M.M.c.f. of imported gas annually by 1975.

The northeastern section of the United States also may offer a potential market for imported gas. Competitive prices again could be the factor.

Northeastern gas distributors now pay pipeline companies 34.2 cents per M.c.f. at 100% load factor for gas in Maryland, New Jersey, New York, and Pennsylvania; 42.2 cents per M.c.f. in New York, and 49.5 cents per M.c.f. in New England.

Consolidated Edison of New York recently paid a total of 42.63 cents per M.c.f. for Texas gas—19.25 cents per M.c.f. to the producer and 23.38 per M.c.f. pipeline charges.

One estimate puts cost of moving liquefied gas from Venezuela to New York at 21 cents per M.c.f. which edges Consolidated Edison's pipeline costs from Texas to New York. The rising costs of southwestern pipelined gas in the Northeast make it quite possible that imported liquefied gas can find an American market.

The future . . . Until the "Methane Pioneer" completes its experimental runs and the technical and economic data are available, the future of liquefied natural gas is in the crystal-ball realm.

But its success opens up a whole batch of possibilities.

Imported gas could become a problem to U. S. domestic gas industry just as imported crude is now to American oil producers.

Imported gas in Europe not only could move into coal markets but also could displace some of oil's markets in European homes and industries.

FPC member Connole put the possibilities this way: "Problems of the petroleum industry in handling its oil-import dilemma will be minor compared to the problem which will beset the coal, oil, and natural-gas industries once liquefied methane by tanker becomes a reality."

watching WASHINGTON

Joe Reilly

• Gas price gains slightly on crude price

THE PRICE GAP between crude oil and natural gas continued to narrow in 1958.

A year-end report from the U. S. Bureau of Mines says the average value of crude oil at the well last year dropped to $3.01 per barrel, 8 cents less than in 1957. The wellhead value of natural gas, according to the same source, rose from 11.3 cents in 1957 to 11.7 cents in 1958.

Besides following opposite price trends, crude oil and natural gas also reacted differently to changing demand patterns during the 1958 recession.

The bureau estimates U. S. crude production for the year at 6,700,000 bbl. per day, down 467,000 bbl. daily. Marketed natural gas, though increasing at a lower rate than in past years, still gained an estimated 3% to 11,015 billion cubic feet for the year.

Last year producers received nearly 20% as much for their gas as they did for crude oil. As recently as 1955 gas brought less than 15% of crude-oil's share.

THE AVERAGE FIELD PRICE of gas in the U. S. is, at best, an educated guess. At least three federal agencies put out prices purported to be average. Each of the quotations is different from the others.

The FPC recently listed the average price paid by interstate pipeline companies to independent producers at 12 cents per M.c.f. (OGJ, Dec. 8, p. 47). The Bureau of Mines lists the 1957 average at 11.3 cents and the 1958 average at 11.7. The Bureau of Labor Statistics, though not figuring the average price for the year, shows the field price reaching 13.32 cents last fall.

The prices vary, depending on sources of quotations, definition, adequacy of survey, and other factors. But the agencies agree on one point —the trend is sharply upward.

Because of the growing demand for gas and, in spite of federal controls, natural gas promises to make further price gains in relation to oil. But it has a long way to go to close the gap. On a B.t.u. basis, crude oil is still bringing more than four times the price of gas.

BESIDES SUMMARIZING OIL AND GAS operations during the past year, the Bureau of Mines report also has an interesting statement on the lead and zinc industries.

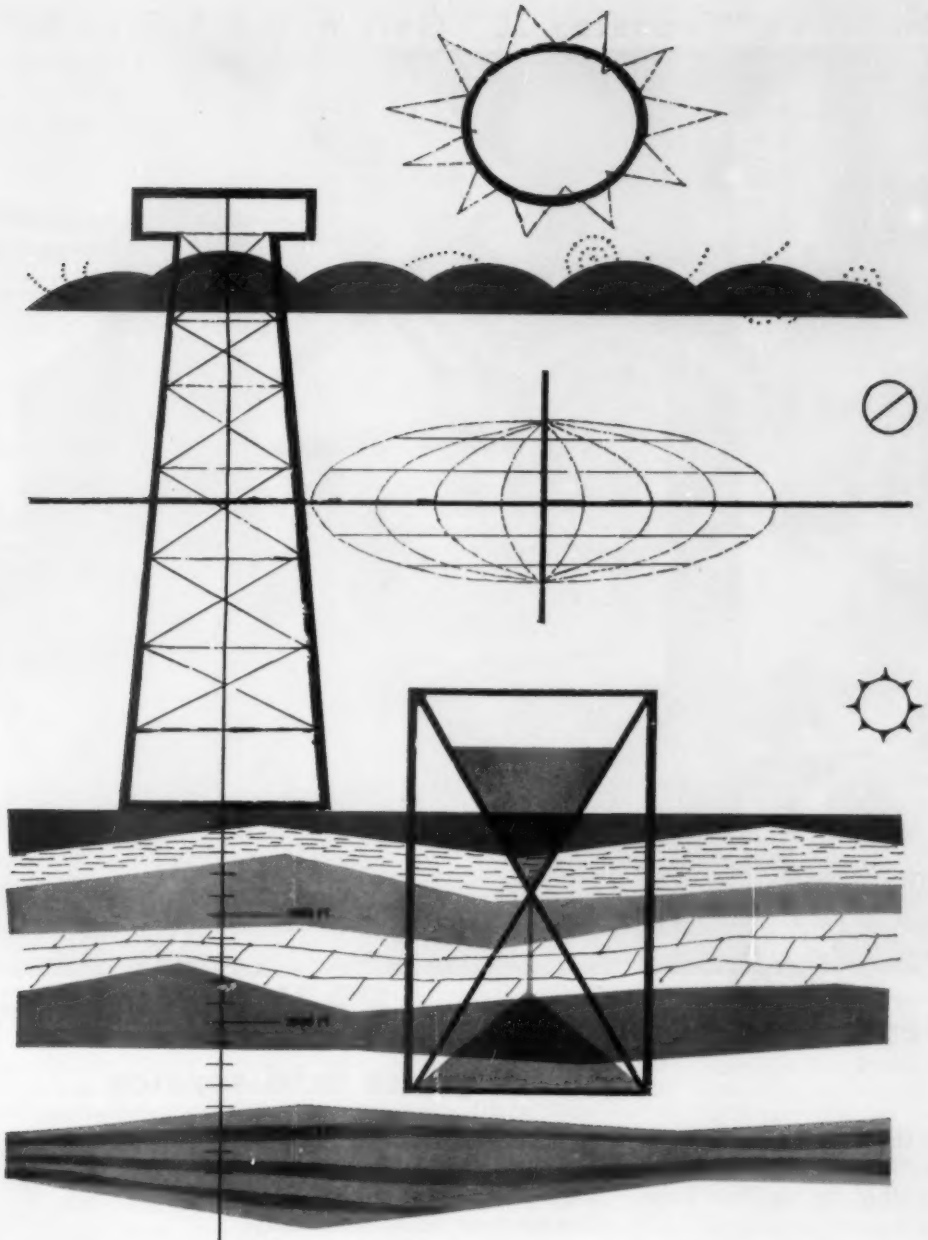
Lead and zinc, like crude oil, are subject to import quotas. Unlike oil quotas, those covering these two metals are allocated among exporting countries. Again unlike oil, both lead and zinc have enjoyed sharp price increases since the controls went into effect.

Lead and zinc import quotas came about in much the same way as those on oil. An investigation by the Tariff Commission indicated imports were impairing the domestic mining industry. It recommended that the President take remedial action. Congress considered legislation for direct aid to domestic miners, but the measure was not passed.

President Eisenhower set import quotas, effective October 1, based on 80% of average U. S. imports in 1953-1957.

The order had immediate effect, the Bureau of Mines notes:

"The imposition of import quotas and an upturn in consumption during the last quarter of the year were reflected in price rises in zinc from 10 cents a pound on October 1 to 11½ cents November 7. Lead rose from the year's low of 10.75 cents in August to 13 cents October 14."



NBT

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NATIONAL BANK OF TULSA TULSA, OKLAHOMA

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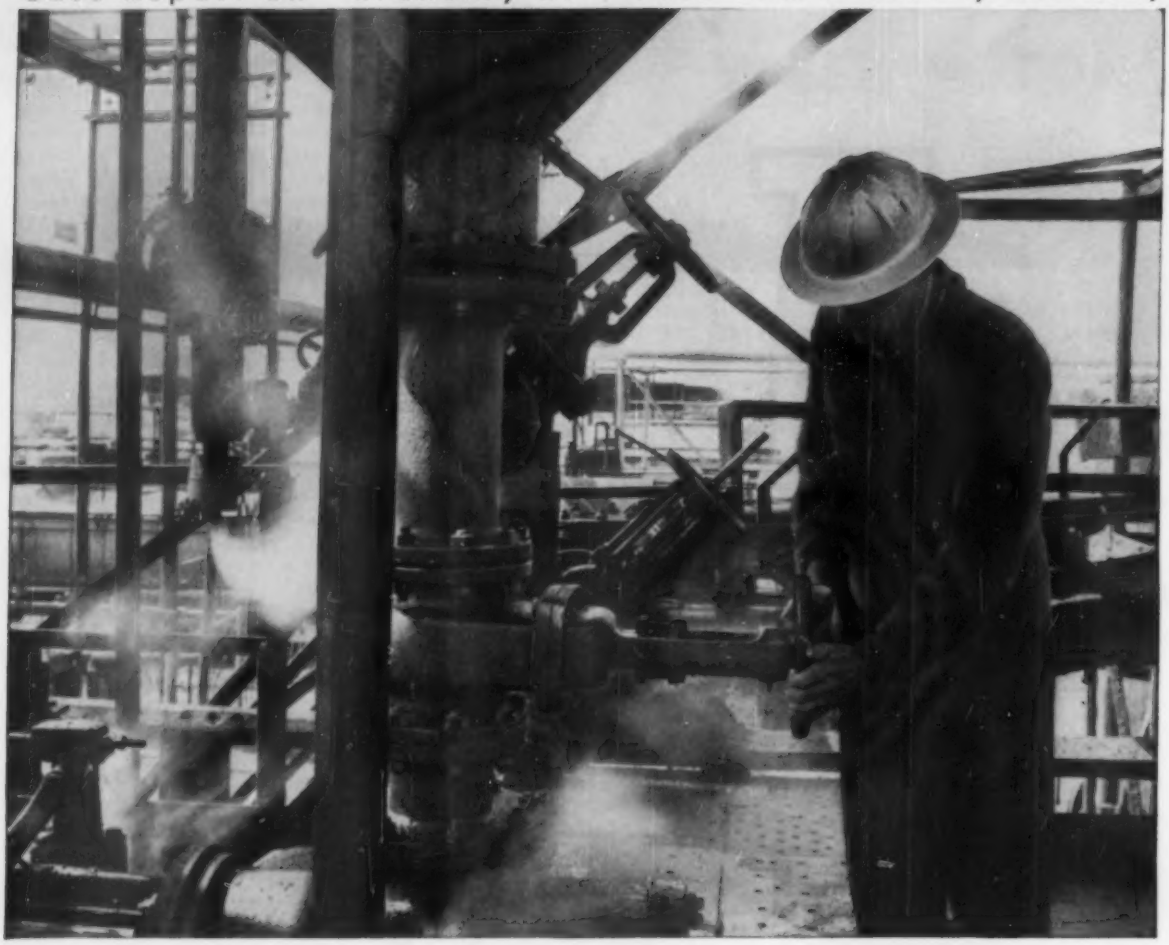
Case Report on "Craneloy 20" Gate at D-X Sunray Refinery



Best valve performance ever on toughest acid service . . .

. . . So says the D-X Sunray Oil Co. about this "Craneloy 20" gate on sludge draw-off at the big West Tulsa refinery.

Installed at the agitator bottom, this 6-inch Crane valve is handling various hot sulphuric acid sludge mixtures—concentrated and weak—steam-diluted to as low as 30%.

Valves used previously had to be replaced every 3 to 6 months. But this "Craneloy 20" gate went a full 14 months before minor repairs—then was put right back into service. It has the best record of any valve used on this toughest job in the refinery.

Specially developed for sulphuric acid at elevated temperatures, "Craneloy 20" is a high-nickel, high-chromium stainless. Teamed with Crane split-wedge, rotating-disc seating design, it makes a valve no corrosive fluid processor can afford to overlook for truly low-cost flow control.

GET FULL FACTS on "Craneloy 20" and other Crane quality alloy valves and fittings. Ask your Crane Representative for Circular AD-2080, or write to address below.

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How Natural Gas Grew in 1958

	1958 (Est.)	1957	Per Cent Change
Customers (at December 31)			
Residential	26,513,000	25,492,000	+ 4.0
Commercial	2,176,000	2,079,000	+ 4.7
Industrial	116,000	114,000	+ 1.8
Other	35,000	31,000	.....
Total	**28,840,000**	**27,716,000**	+ 4.1
Sales (thousands of therms)			
Residential	26,614,600	24,277,700	+ 9.6
Commercial	7,352,800	6,693,900	+ 9.8
Industrial	40,031,700	40,120,000	— 0.2
Other	3,283,800	3,921,100	.....
Total	**77,282,900**	**75,012,900**	+ 3.0
Revenues			
Residential	$2,415,656,000	$2,117,853,000	+14.1
Commercial	527,448,000	461,040,000	+14.4
Industrial	1,187,657,000	1,118,055,000	+ 6.2
Other	96,592,000	99,902,000	.....
Total	**$4,227,353,000**	**$3,796,850,000**	+11.3

Gas Industry Sets Records

. . . during 1958 which are expected to fall this year. AGA paints rosy picture, with boosts predicted through 1968.

THE GAS industry enters 1959 with prospects for continued growth following a record year in 1958.

The bright outlook is pictured in an annual report by the American Gas Association. The AGA report covered natural, manufactured, and mixed gas.

The industry will spend between $1.7 and $1.8 billion this year (about the same amount as last year) for construction and development of gas transmission, distribution, and storage. About 97% of this is earmarked for natural-gas facilities. Construction outlays are expected to total $8.1 billion for the 4-year period 1958-61, compared with $5.7 billion spent during the period 1954-57.

The gas industry had a record-breaking 32 million customers at the end of 1958, and revenues soared to an all-time high of more than $4.5 billion.

The average number of 31.4 million customers during the year—a 2.9% increase over 1957—is expected to rise to 34 million during 1961 and to 38 million by 1965, including 34.9 million residential users.

Natural-gas customers averaged 28.1 million during the year, a 3.9% boost over 1957. The switch to natural gas was shown by the average number of 3.1 million customers receiving manufactured and mixed gas, a 4.5% drop from 1957. However, sales and revenues from these fuels were up 4.2% and 2.2%, respectively.

Over-all revenues hit $4,574 million, a 10.6% gain over the previous record of $4,136 million during 1957.

About 15,300 miles of pipelines and mains were added in 1958, bringing the total to 564,100 miles. The systems are expected to total 750,000 miles within the next 9 years.

Gross plant at the end of the year was $18.4 billion, up 10.2% from the close of 1957. It's expected to reach $19.9 billion this year and to double within the next 10 years.

PIPELINE BRIEFS . . .

Great Northern Railway is reducing crude transportation rates between four refineries and seven new producing areas in the northwest North Dakota portion of the Williston Basin. Beginning January 23, the rate will be 27 cents a hundredweight, 4 cents lower than at present, on crude shipped from the Antler, Bowbells, Maxbass, Newburg, Noonan, Sherwood and Westhope areas. Terminal points are Minnesota Transfer, St. Paul Park and Alford, Minn., and Superior, Wis.

Coastal Transmission will complete a 94-mile, 12-in. segment of its McAllen, Tex.-Baton Rouge, La., gas line this week. O. R. Burden Construction Corp. is winding up work on the project from McAllen to Robstown, Tex.

Contract to build a 100-mile, 12-in. natural-gas line for Niagara Mohawk Power Corp., Syracuse, N. Y., has been awarded to Fulghum Contracting Corp. The line, not yet under way, will extend from Watertown to Massena, N. Y. Completion is scheduled for August 1, 1959. Consolidated Gas & Service Co. has the contract for 26 miles of 12-in. for Niagara Mohawk from Volney to Ellisburg, N. Y. The project is under way and will be finished May 1. Niagara recently completed a 40-mile, 24-in. line from Oneida to Phoenix, N. Y.

A 267-mile construction program is planned next year by Saskatchewan Power Corp. The aim is for every city in Saskatchewan to have a natural-gas distribution system by the end of the year. The 1959 program is an increase over last year's construction for the government-owned company.

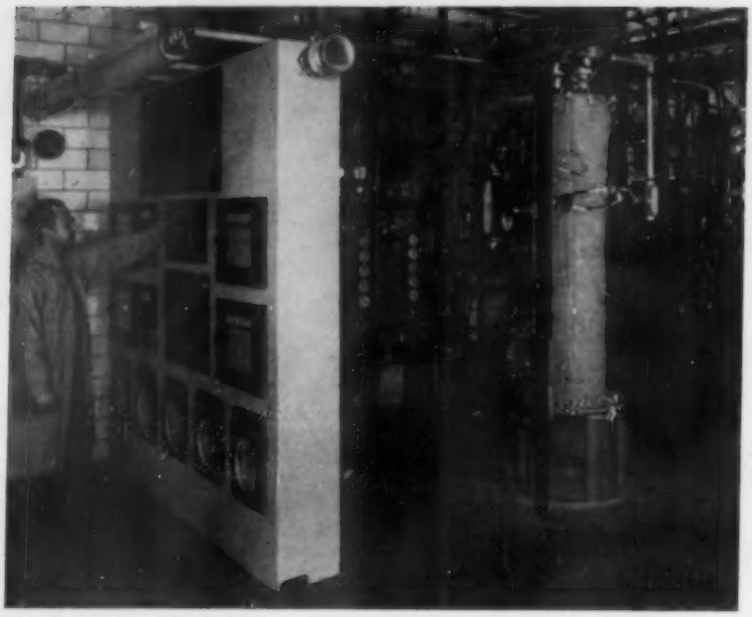
A 1959 expansion of 31½ miles is planned by Western Slope Gas Co., Denver. The company plans to extend its 4, 6, and 8-in. gathering lines in Colorado to connect new supplies to meet increased demand for gas.

Also for Pipeliners . . .

IN THE NEWS: Double jointing is speeded with Bechtel's new automatic-welding equipment for field yard operations (p. 70) . . . The "Methane Pioneer" starts its historic voyage from Louisiana to England this month taking first overseas cargo of liquefied methane (p. 76) . . . The domestic gas industry closes out another record year. Prospects bright for 1959 (p. 81).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are reported in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Series-parallel centrifugal compressors provide for greater flexibility (p. 123) . . . Interface Detectors: Still room for improvement (p. 133) . . . Needed: A good batch interface detector for product pipelines (p. 134).



Catalyst Research Done Automatically

AN AUTOMATIC pilot plant in the research laboratories of Standard Oil Co. (Ind.) is aimed at development of better, longer lasting, and more versatile catalysts for petroleum-refining operations.

The company array of equipment is for studying the behavior of catalysts used to speed chemical reactions in petroleum refining. It has been in operation since June 1957.

The automatic plant gives catalysts the same treatment they would get in full-sized refinery equipment, but much faster. The plant is fully instrumented in the same way that a commercial process would be instrumented in a refinery. Flows, temperatures, pressures, and liquid levels are carefully interrelated and controlled. Once a day an engineer takes readings from the recorders.

It also is equipped to set off an alarm if anything goes wrong, such as abnormal temperature, pressure, or liquid flow rates.

PG&E Makes Bid

for FPC approval of a big Canada-California gas line.

THE MOVE by Pacific Gas & Electric Co. to import Canadian natural gas into central and northern California markets took a big step forward last week.

Pacific Gas Transmission Co., a PG&E subsidiary, applied to the Federal Power Commission for approval to build a 614-mile pipeline from the U. S.-Canada border to the California-Oregon line.

This $129.5-million segment of a planned $330-million system, will run from near Kingsgate, B. C., to Klamath Falls, Ore.

The PG&E project calls for a 1,300-mile line capable of moving 420,000 M.c.f. daily of Alberta gas to the San Francisco Bay region (OGJ, July 22, 1957, p. 64).

Other plans . . . PG&E also announced plans to start a third loop parallel to the line which moves gas from Texas and New Mexico into its system.

This third line will start with a 49-mile, 34-in. section along the 500-mile existing lines from Topock on the California-Arizona border to the San Francisco Bay region.

The new 49-mile segment and an additional 13,500-hp. compressor capacity will enable PG&E to boost its Texas-New Mexico imports to more than 1,130,000 M.c.f. daily.

INDUSTRY BRIEFS . . .

Dates for Texas Railroad Commission allowable hearings in 1959 were announced last week. The first four meetings will be at the Stephen F. Austin hotel January 15, February 20, March 19 and April 16. The next four meetings will be at the Commodore Perry hotel May 20, June 18, July 17 and August 20. The October 16 meeting also will be at the Perry. Three meetings will be at the Driskill hotel September 18, November 20 and December 18.

The National Petroleum Council's organizational meeting for the new year has been rescheduled for January 27 in Washington. High on the agenda will be consideration of changes in the council's articles of organization to meet criteria for business advisory groups as laid down by the attorney general (OGJ, Dec. 29, p. 80). The meeting was postponed from December 29.

The oil and chemical industry was top investor in new plants in Louisiana in 1958. More than $75,485,000 was spent on new chemical and petroleum-products plants last year, representing about 38% of the state's total plant investment.

An improved nuclear gage for measuring liquid levels in sealed, large-diameter tanks with steel walls is one of the new targets of the U. S. Atomic Energy Commission. The project is included in a recent contract awarded to Nuclear Science & Engineering Corp., Pittsburgh. It's part of the commission's program to stimulate use of radioisotopes by industry.

Kansas allowable for January remains unchanged at 327,000 bbl. daily. This is the third consecutive month that the state corporation commission has set the figure at that level.

Louisiana has set the January oil allowable at the December level, with allowance for about 8,000 bbl. daily increase for new production. The output will hit an estimated 856,000 bbl. daily. Conservation Commissioner Ashton J. Mouton did not change the per-well allowable formula, although some crude buyers had asked for a cutback.

Construction has started on a $3-million expansion at Champlin Oil & Refining's Gulf Plains natural-gas processing plant in Nueces County, Texas. Engineering and construction is being handled by Fluor Corp., Ltd.'s Mid-Continent division in Houston. Completion is slated by August.

because of GLYCOLS *and* ETHANOLAMINES

Wet or sour gases, once flared as a nuisance, now produce millions in revenue — thanks to the glycols and ethanolamines. If you use these versatile chemicals for gas dehydration or purification, you want to be sure of steady supply and instant service. Allied glycols and ethanolamines are available in tank car lots from Nitrogen Division's Orange, Texas plant, and in tank trucks or drums from warehouses in principal producing areas. Allied's technical specialists are always on call to help with any application problems you may have.

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November Crude, Product Imports Up

• Crude is 41,000 bbl. above quotas; products average 16,800 bbl. higher than May-June average desired level.

RISING OIL imports are threatening to wipe out the last faint hopes for continuation of a voluntary control program.

Latest Government statistics show that November imports of both crude oil and unfinished products exceeded their quotas.

A sharp rise in imports was reported by Capt. Matthew V. Carson, Jr., administrator of the voluntary control program. His report was expected to increase the pressure for mandatory controls.

Carson reported crude imports for the entire country rose to 975,900 bbl. daily. This represents a gain of more than 50,000 bbl. per day over October imports and exceeds allocations by more than 41,000 bbl. per day.

Net excess of imports over quotas was all attributed to Districts 1-4,

Here's What Companies Imported During November

CRUDE OIL—DISTRICT 5

(Thousands of barrels daily)

	Allocation November 1958	Actual November 1958	Actual October 1958
Bankline	2.3	8.1	0
Caminol	2.8	2.8	2.8
Century	1.5	5.2	0
Douglas	4.4	3.3	3.8
Edgington	2.8	1.3	2.4
Envoy	1.2	0	0.7
Fletcher	5.2	5.2	5.2
Golden Eagle	2.3	0	4.1
General Petroleum	23.9	24.3	23.5
Hancock	4.0	0	0
Manespo	1.4	4.7	0
Macmillan	2.3	2.3	2.3
Mohawk	2.9	0	0
Palomar	0.5	0	0
Richfield	8.5	10.4	6.4
Rothschild	2.7	0	5.2
Shell	30.4	31.3	28.2
Socal Oil & Refining	1.0	0	0
Standard of Calif.	27.8	23.9	33.4
Sunland	2.3	7.0	0
Texaco	19.3	23.5	10.7
Tidewater	35.5	26.3	44.1
Union	11.6	10.9	11.4
U. S. Oil & Refining	7.5	0	0
Wilshire	17.0	15.3	11.3
Total	**221.1**	**205.8**	**195.5**

CRUDE OIL—DISTRICT 1-4

(Thousands of barrels daily)

	Allocation November 1958	Actual November 1958	Actual October 1958
Atlantic	50.2	49.3	44.6
Aurora Gasoline	3.5	3.5	3.5
Bay Refining	2.7	4.0	3.0
Cities Service	27.8	28.8	24.1
Clark	2.0	0	5.9
Continental	5.0	5.0	5.0
Crown Central	4.3	4.3	4.3
Danaho	0.5	0.5	0.5
Delta	3.0	*9.0	*9.0
Dow Chemical	0.3	0	0
Eastern States	15.6	†44.3	†55.1
Gabriel	6.4	6.4	6.4
Great Northern	28.1	31.4	22.0
Gulf	95.1	96.9	91.9
Hess, Inc.	9.8	8.5	10.5
Ingram	3.5	7.9	8.7
International	10.5	17.3	9.0
Lakehead	0.3	0.2	0.2
Murphy Corp.	4.3	0.6	4.6
Northwestern	11.5	14.8	9.5
Ohio Oil	3.5	3.6	3.6
Phillips	10.2	9.9	10.0
Pure	5.0	3.9	4.8
Republic	4.0	0	6.9
Shell	6.4	1.6	5.1
Sinclair	53.0	53.7	52.6
Socony Mobil	57.2	63.4	50.9
Southwestern	2.5	11.5	4.6
Standard of Calif.	56.9	60.9	55.1
Standard of Indiana	25.4	29.1	23.6
Standard of N. J.	61.4	67.8	65.5
Standard of Ohio	7.0	9.0	9.4
Sun	43.0	53.6	26.3
Sunray Mid-Continent	5.0	5.7	5.7
Tennessee Gas	3.5	3.6	3.6
Texas Asphalt	2.0	2.0	2.0
Texas City Refining	4.0	4.1	8.2
Texaco	46.4	46.0	45.9
Tidewater	29.2	8.0	24.4
United	3.0	0	2.9
Total	**713.0**	**770.1**	**728.9**

*Estimated. †From Texas Railroad Commission.

UNFINISHED GASOLINE, OTHER UNFINISHED OILS

DISTRICTS 1-5

(Thousands of barrels daily)

	Average May-June 1958	Actual November 1958	Actual October 1958
Atlantic	5.7	8.3	3.3
Crown Central	5.6	3.0	9.1
Eastern States	12.3	†0	†0
Gulf	16.3	10.2	16.4
Hess, Inc.	25.3	43.5	26.9
Sinclair	7.3	7.4	8.3
Socony Mobil	19.7	21.2	16.1
Southwestern	4.1	4.5	4.2
Standard of Calif.	8.5	7.9	14.4
Standard of Indiana	24.8	32.2	19.1
Standard of Ohio	1.7	0	0
Texas City Refining	7.0	4.6	4.1
Texaco	13.8	14.4	9.8
Tidewater	20.0	28.7	17.5
Union	4.7	5.9	8.7
U. S. Oil & Refining	2.6	4.4	4.7
Total	**179.4**	**196.2**	**162.6**

†From Texas Railroad Commission.

which cover principally the states east of the Rockies.

Imports of unfinished gasoline and other unfinished oils rose to 196,200 bbl. per day, Carson reported. The total is 16,800 bbl. per day above the May-June average of 179,400 bbl. at which Carson had sought to draw the line.

The rise in November imports reversed the pattern of the preceding month, when total imports of both crude and unfinished products were held within their recommended quotas. The increase, though not spectacular in itself, nevertheless could prove a fatal blow to the voluntary import program.

More teeth? . . . Critics of the program have contended for months that voluntary controls would not work.

The program, which was scheduled to expire at the end of 1958, is being extended until February 28 to permit more time for the cabinet fuels committee to work out a new program.

Failure of the committee to agree on new recommendations to be made to the President has been taken as an invitation for Congress to settle the issue.

Whether the new program eventually comes from the White House or the capitol, it is expected to have more teeth in it than the present program.

The Government's policy against buying from non-complying companies has proved ineffective as far as a few companies are concerned.

Products also over . . . Eastern States and Delta Refining Co., both consistent non-compliers, account for most of the crude imports in excess of quota.

Carson's reports show, though, that several other companies have exceeded their crude quotas at least 3 months in succession. They include Ingram Oil & Refining Co., Standard Oil Co. (N. J.), Standard Oil Co. (Ohio), and Texas City Refining Co.

For most of the other companies, crude imports in excess of quotas can be attributed to fluctuations in delivery schedules and other such factors that result in temporary non-compliance.

As far as unfinished products are concerned, Hess, Inc., received the largest non-quota shipments. Others listed as exceeding their product quotas for 3 months straight include Sinclair Refining Co., Union Oil Co. of California, and U. S. Oil & Refining Co.

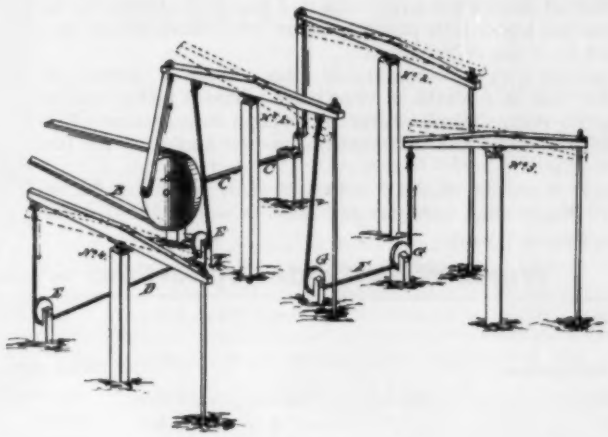
Coming January 28 . . .

Petroleum Panorama

A. E. NICKERSON & L. C. STREETER.

Means for Pumping Wells.

No. 6,486. Reissued June 15, 1875.



WITNESSES: P. C. Dieterich. H. C. McArthur.

INVENTORS: Albert E. Nickerson. Levi C. Streeter. By C. A. Watson & Co. ATTORNEYS.

WHEN Albert E. Nickerson and Levi C. Streeter of Allegheny Township, Pennsylvania, had this drawing prepared, the oil industry was only 16 years old. The sketch was used to support their application for the first patent for "pumping two or more wells simultaneously." The patent was issued April 20, 1875, and reissued June 15, 1875.

As these early-day technologists explained, "By an examination of the drawing it will be seen that the walking beam to well No. 1 is lifting or raising fluid from the well. Well No. 3 is also lifting; while at the same time wells 2 and 4 are moving in an opposite direction, or plunging." And ever since then, inventors have been adding to the technology of the industry, seeking new ways to get more work, or better quality, for less cost.

Hundreds of drawings such as this one, and thousands of historical photographs, have been examined by Journal editors in the last 2 years. Staff members have been busy extracting and putting into perspective all those significant ideas and actions which contributed to the development of the drilling, producing, pipelining, and refining divisions of the oil industry through its first 100 years. The finished product—Petroleum Panorama—is a comprehensive and colorful history of oil from Colonel Drake to Captain Carson.

This 662-page special issue will reach the desk of all subscribers within a few days after the regular Journal issue dated January 26. It's the Journal's hundredth-anniversary salute to the magnificent oil industry (see Journally Speaking, p. 61)—and it's free to all subscribers of record on January 28.

World Output Dips

. . . slightly from previous month's record high. U. S. down, while Kuwait, Iraq hit top peaks in history.

FREE-WORLD crude production slipped slightly in October, but it still was the second highest in history.

The over-all decline was largely due to a loss in the United States. Other areas had higher total production than ever before, pushed to a new record by a rise in Venezuela.

Two records were set in the Middle East, despite a general decline in the area as a whole. Kuwait came within a tanker load of producing 1.5 million barrels daily. Iraq output rose to a new high of 817,700 bbl. daily, and its production passed Iran's for the first time in 2 years.

Mexican production neared 270,000 bbl. daily going into the fall season. If Pemex holds onto the gain, the rise will be the first sustained increase in 4 years.

TREND OVER THE LAST YEAR

	Western Hemisphere less U.S.	Middle East	Total Free World outside U.S.
1957			
October	3,751.2	3,887.9	8,436.5
November	3,654.7	3,704.2	8,412.4
December	3,661.7	3,973.6	8,412.4
1958			
January	3,680.4	4,034.0	8,465.6
February	3,798.7	4,057.6	8,662.1
March	3,672.6	4,243.0	8,631.3
April	3,613.5	4,109.2	8,528.0
May	3,582.9	4,087.8	8,468.2
June	3,678.0	4,156.8	8,654.2
July	3,777.0	4,247.2	8,832.6
August	3,828.4	4,334.0	8,971.5
September	3,769.8	4,535.2	9,120.8
October	3,868.4	4,467.6	9,142.0

World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	Oct. 1958	Sept. 1958	Oct. 1957
Western Hemisphere			
Argentina	95.6	95.6	95.3
Bolivia	9.1	9.1	9.4
Brazil	57.4	57.4	29.5
Canada	438.0	437.7	447.8
Chile	15.7	15.7	13.4
Colombia	133.8	133.8	125.6
Cuba	0.9	0.9	1.2
Ecuador	9.0	9.0	9.2
Mexico	269.0	269.0	248.5
Peru	54.3	54.3	53.4
Trinidad	104.6	104.2	96.9
Venezuela	2,681.0	2,583.1	2,621.0
Total	3,868.4	3,769.8	3,751.2
Europe			
Austria	51.6	51.6	57.9
France	27.8	27.8	26.9
West Germany	89.1	88.9	79.1
Italy	33.6	33.6	27.7
Netherlands	31.1	31.1	32.2
Turkey	6.5	6.5	6.5
United Kingdom	1.7	1.7	1.7
Yugoslavia	9.2	9.2	8.0
Total	250.6	250.4	240.0
Middle East			
Bahrain	43.3	43.3	34.5
Iran*	816.0	909.0	768.0
Iraq†	817.7	800.8	550.3
Israel	2.0	2.0	1.2
Kuwait	1,494.1	1,442.0	1,257.6
Neutral Zone	84.1	84.1	89.0
Qatar	165.0	174.0	142.6
Saudi Arabia	1,045.4	1,080.0	1,044.7
Total	4,467.6	4,535.2	3,887.9

Country—	Oct. 1958	Sept. 1958	Oct. 1957
Other Asia			
British Borneo	104.6	104.6	113.4
Burma	10.5	10.5	8.4
India	8.5	8.5	7.7
Indonesia	315.0	325.0	350.8
Japan	7.0	7.0	6.3
New Guinea	5.4	5.4	5.9
Pakistan	5.9	5.9	5.6
Total	456.9	466.9	498.1
Africa			
Algeria	11.6	11.6	0.2
Angola	2.0	2.0	
Egypt	65.3	65.3	52.5
Gabon	11.6	11.6	5.1
Morocco	1.4	1.4	1.5
Nigeria‡	6.6	6.6	
Total	98.5	98.5	59.3
Free World			
Foreign	9,142.0	9,120.8	8,436.5
United States	6,978.0	7,099.0	6,860.0
Total	16,120.0	16,219.8	15,296.5
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	224.0
Russia	2,230.0	2,230.0	2,070.0
Others	60.0	60.0	50.0
Total	2,525.0	2,525.0	2,344.0
WORLD TOTAL	**18,645.0**	**18,744.8**	**17,640.5**

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 3,600 bbl. daily from Naft Khaneh field, operated until December by British Petroleum Co. ‡Test production.

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking.

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- Safety joint allows tubing to be removed. Packer is easily drilled if conditions prevent normal removal.

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Oil Still Smoldering

. . . over Venezuela's bigger tax bite. Extra tab expected to cost industry $170 million for operations during 1958.

WHEN VENEZUELA'S new and sudden income tax boost hit the country's oil industry last month, it was like hardened steel against flint.

The resulting shower of sparks threatened for a time to start a fire. Last week, oil company spokesmen had stopped flaring, but there was still plenty of glow.

The surprise move of Venezuela's provisional government upsets the country's traditional 50-50 profit split on oil operations that has been in force for 15 years. The new income tax decree will probably mean that the country's big oil producers will pay the government more than 60% of the income from oil.

The new tax decree applies to all industry, but oil feels it is aimed squarely at it. Nine of 10 of the country's biggest companies are oil producers.

Quick estimates of the effect of the new tax indicate the new decree will cost the oil industry $170 million more in taxes than it expected to pay on 1958 operations.

The sudden and added tax bite brought some immediate denunciations from oil company officials (OGJ, Dec. 29, 1958, p. 83). The industry's outraged comments drew some return fire from Venezuela, too.

The loudest yell of all came from H. W. "Duke" Haight, president of Creole Petroleum, the country's biggest oil producer. He said Venezuela's temporary government broke its pledge not to upset the apple cart in the wake of the country's revolution.

Rebuttal . . . This drew a biting blast from Dr. Marcos Falcon-Briceno, Venezuelan ambassador to Washington, who said Haight's remarks were offensive to his country's national dignity.

"The sovereign government of Venezuela has not yet reached the point where it must obtain permission from Creole Petroleum Corp. to increase taxes, any more than the sovereign government of the United States must obtain permission from Creole's parent, Standard Oil Co. (N. J.), before income taxes are increased or decreased there."

The ambassador added that "our increased income tax rates are still modest as compared with similar taxes in the United States."

Creole, Jersey Standard, Shell, Socony, and Sinclair all said pointedly that the additional taxes would compel them to take another and closer look at any future investment in Venezuela. All implied that they'd prefer not to sink any additional money in the country under what they consider an onerous tax burden.

Peace-maker . . . At this point Washington stepped quietly and unofficially into the picture in an effort to smooth ruffled feelings all around.

State Department officials spent a good part of the week that followed the surprise tax decree conferring with oil officials. There was no official comment from Washington. But it was clear the Government feels the charges and countercharges have gone far enough.

State Department officials said privately they are afraid the acrimonious exchange may trigger even more radical action on the part of the Venezuelans.

Cancellation not likely . . . In contrast to the oil company opposition to the new tax decree, there is growing popular, political, and labor support for the move in Venezuela.

Dr. Edgard Sanabria, president of the provisional junta which sprang the new tax, insisted there is no doubt about its "absolute legality."

Julio Diez, new minister of mines and hydrocarbons, said the move was made "after a careful and thorough study." He called it an "act of sovereignty" and shrugged off the complaints voiced by Haight.

The Unified Trade Union Committee, central body of the Venezuelan trade movement, declared its support for the new decree.

Romulo Betancourt, the new president-elect who takes office late this month after Venezuela's first democratic election in more than 10 years, was obviously caught just as far off base as was the oil industry. He promised throughout his campaign he'd work for added income from oil, but specified it would be done by negotiation with the industry.

Last week Betancourt had made no statement concerning the new decree, but Accion Democratica, the political party he heads, is supporting the temporary government's action. The country's other two major political parties, Christian Democrat (Copei) and Republic Democrat Union (URD), are also supporting it.

El Nacional, one of the large Caracas daily papers, took sharp issue with reports published in the U. S. that Venezuela had to raise taxes to make up the treasury deficit left by the ousted regime of Dictator Marcos Perez Jimenez.

"In truth, the reason is more serious . . ." El Nacional said. "As Betancourt has been pointing out for a long time, Venezuela has not been receiving its rightful benefits from its oil wealth."

Daily Fee Is Set

by Japanese firm for IDC's drilling in Persian Gulf.

A 2-YEAR contract for work in the Persian Gulf will pay the drilling contractor $9,500 per work day.

The contract was tied down by International Drilling Co. The Hague-based firm made the deal several weeks ago with Arabian Oil Co., the Japanese firm with offshore rights to the Neutral Zone. The agreement has now been approved by Japan's Ministry of International Trade and Industry. The contract calls for payment on a work-day basis at a rate of $9,500 per 24-hour day. This method of payment is counter to the trend in the Gulf of Mexico, where more and more contract deals have been based on footage.

International Drilling's offshore equipment, supplied by Reading & Bates Offshore Drilling Co., Tulsa, left Orange, Tex., on Christmas Eve. It is scheduled to reach the Neutral Zone on April 10 with drilling to start about April 25. The gear includes a mobile drilling platform, a tender, a transport vessel, and a workshop (OGJ, Nov. 17, 1958, p. 150).

Arabian Oil's plans do not leave much leeway for possible dry holes. The company is confident that commercial oil will be found quickly, but it is still trying to raise capital to exploit it.

The company's paid-up capital amounts to $9.5 million, but 1959 operations will cost about $12.5 million. Of this amount, rentals to Saudi Arabia and Kuwait will take $3 million, drilling costs, $7.5 million, and supplies and other expenses the rest.

Most of the additional funds are being sought from the Japanese Government and from banks. The company has given the government an optimistic 5-year plan which anticipates a cumulative production of 163 million barrels by the end of 1964. The hoped-for crude production goal for 1964 is 173,000 bbl. daily.

Turkish Acreage Granted Texas Firm

• Geological studies of concessions covering 1,000,000 acres will precede seismic work, selection of drilling prospects. One block is near Kahta field.

PAN AMERICAN Land & Oil Royalty Co., Dallas, has obtained concessions totaling nearly 1,000,000 acres in Turkey from the Turkish Government.

The new concessions, granted under provisions of Turkey's petroleum law, include 187,740 acres in District 5, 481,372 acres in District 6, and 244,131 acres in District 2. Districts 5 and 6 are in southeastern Turkey, District 2 in the western part of the country.

Pan Land Oil already has engaged DeGolyer & MacNaughton, Inc., to make a detailed geological study of the acreage prior to launching seismic work and selecting drilling prospects.

Wilbur S. Sherman, Pan Land Oil president, said in Dallas last week that the concessions in each district include several acreage parcels. He said the two parcels in District 5 and the four in District 6, both in proved oil provinces, either cover well-defined anticlinal structures or are located on important anticlinal trends under concession to other firms.

Sherman pointed out that the company's "A" block in District 6 is about 55 miles west of Kahta field discovered by American Overseas Petroleum last year.

Company expanding . . . Pan American Land & Oil Royalty, though a relatively new company on the international oil scene, has been competing effectively in recent months for promising foreign concessions.

The firm was originally organized in Dallas in 1956 as Cuban Land & Oil Royalty Co. It pulled off its first big deal in Cuba in October 1957 (OGJ, Oct. 21, 1957, p. 90) by exchanging stock for more than 1,300,000 acres of concessions and overriding royalties on nearly 20,000,000 more acres.

Acting president of the firm then was Rufus Brent, Dallas, vice president of Producing Properties, Inc., Dallas. Following the Cuban deal, the company changed to its present name and Sherman succeeded Brent as president. Brent continues as vice president.

Directors include Ralph Bard, president of Chicago-Canadian Holdings, Ltd.; Guillermo Belt, former Cuban ambassador to the U. S.; H. N. Mallon, chairman of Dresser Industries, Inc., Dallas; F. Lee Moore, Jr., of Kidder, Peabody & Co., New York investment house; Jay H. Shcrafrann, partner in the law firm of Arismendi, Brigard & Poraga, New York; and Brent and Sherman.

The firm acquired acreage in Cuba, scattered through Oriente, Havana, Las Villas, Camaguey, and Matanzas provinces. Bulk of the acreage is in Oriente.

Kahta field . . . Three wells have been completed in the field. They are not flowing wells and are being tested with various kinds of pumping equipment.

The discovery, the 1 Kahta, was completed for 600 bbl. daily of 11°-gravity oil from the Mardine limestone. The 2 Khata, drilled 1 km. south of the discovery, was completed in the same pay at 3,640 ft. and listed as an even better producer. However, both wells were on forced pump at an uneconomical rate. The No. 3, about 3 km. west of the discovery, was finaled for a total of about 300 bbl. daily from two oil zones above 4,025 ft.

The No. 4 well, spudded November 8, is now going down about 2 km. east of the discovery.

Other than the Kahta activity, most of the current Turkish drilling is in District 5. Turkish Petroleum is putting down three wells in the Garzan area and drilling ahead at its 7 Kentalan in the Germik area.

Bolsa Chica is drilling ahead at its 1 Kastal wildcat in the same district. And Shell has set 7-in. casing and is drilling below 7,650 ft. in its 1 Kandamis.

Tidewater and others have abandoned their closely watched wildcat, near the Syrian border, the 1 Bakuk, at 13,450 ft.

TABLE I

Effect of changing olefin distribution

(10% Light Olefins replaced by 10% Heavy Olefins)

CAR	DEPRECIATION, OCTANE NUMBER				
	1000 RPM	1500 RPM	2000 RPM	2500 RPM	3000 RPM
E	—	+ 1.1	+0.3	+0.7	+0.9
F	—	—	+0.4	+0.4	+0.5
R	+0.2	+0.4	+0.3	+0.5	+0.4
Average	—	+0.8	+0.3	+0.5	+0.6

The increase in octane number depreciation is shown above when 10 per cent light olefins (<210 deg. F.) are replaced by 10 per cent heavy olefins (>300 deg. F.). Cars E, F, and R are 11-to-1 C. R.

New study shows that the boiling range of hydrocarbons affects road antiknock performance

TWO GASOLINES with the same Research octane number, the same Motor octane number, and the same overall hydrocarbon type composition can differ significantly in road antiknock performance. This variation has been related to different placement of hydrocarbon types in the boiling range of gasolines.

Such was the general conclusion resulting from a program carried out at the Ethyl Research Laboratories in cooperation with a technical group of an oil company.

Why Such a Study

Research and Motor octane ratings are generally accepted specifications for gasoline antiknock quality. Laboratory octane number is both a convenient and simple means of control. Results are easily applied to refinery economic studies of motor fuel components.

But the basic refinery problem is to build into gasoline an octane quality that pays off in road performance. Considerable research in recent years has been aimed at empirically correlating laboratory tests with actual road ratings.

As a result, calculated road octane numbers are now accepted as a means of establishing relative road performance of gasolines.

Present road rating equations relate road performance

to Research and Motor octane number and hydrocarbon composition. During the studies to formulate these equations it became apparent that, in addition to the hydrocarbon composition of the whole fuel, the distribution of the various hydrocarbon types in the boiling range was also significant.

Thus, fractional hydrocarbon effect became a logical subject for isolated study.

Fuel Design and Inspection

For this study, 20 fuels of 100 Research octane number were designed to the specifications in Table II. Each test fuel was blended to provide variations in hydrocarbon type in each of four boiling fractions—C_5-210 degrees F., 210-250 degrees F., 250-300 degrees F., and over 300 degrees F.

These four fractions comprised 40, 20, 20 and 15 per cent respectively of each blend. The remaining 5 per cent was normal butane to fill volatility needs.

Realistic gasoline components were used as shown by two example blends in Table III.

Comprehensive laboratory inspections of the fuels and fractions represented more than 700 laboratory antiknock ratings, 400 hydrocarbon-type evaluations, and complete volatility data.

Test Vehicles and Rating Procedure

Each of the 20 experimental gasolines was evaluated in six test vehicles. Three were 1957 and 1958 production models; the rest had experimental engines of 11-to-1 compression ratio.

Both Modified Borderline and Uniontown techniques were used in the rating program.

Effects of Hydrocarbon Fractions

The following specific conclusions were noted:

1. Low-boiling olefins (C_5-210 deg. F.) generally provide better road octane performance than do high-boiling olefins (over 300 deg. F.).

2. Low-boiling aromatics (less than 300 deg. F.) seem to perform better than high-boiling aromatics (over 300 deg. F.) at lower speeds in each car. There is no significant difference at higher speeds.

3. There are no significant differences in road octane number due to the distribution of aromatics between 250 deg. F., and 300 deg. F.

TABLE II

Fuel Specifications

1. Nominal Research octane number (RON) of 100.
2. Tetraethyllead concentration of 2.5 to 3.0 ml. per gallon.
3. Distillation temperatures at the 45%, 65% and 85% evaporated points of 210, 250 and 300 deg. F. respectively.
4. Volume of normal butane at 5 per cent.
5. Nominal Reid vapor pressure of 7 psi.

TABLE III

Composition of Test Fuel Fractions

Blend No.	C_5-210° F.	210-250° F.	250-300° F.	Over 300° F.
	% Component	% Component	% Component	% Component
11	28 Cat. Poly. 12 Pentene-2	20 Toluene	18 Straightrun 2 Normal Octane	15 Mixed Aromatics
18	32 HF Alkyl. Cut 8 Isohexane	8 Normal Heptane 2 Isooctane 10 Toluene	7 Straightrun 3 HF Alkyl. Cut 10 Mixed Xylenes	15 Cat. Poly.

Note: All blends contained 5% normal butane.

How Ethyl Research is helping you

As a part of their regular program, Ethyl Corporation's Research Laboratories are continually investigating the variables that affect road performance. Frequently, programs take the form of special studies for individual customers.

Other programs are for the benefit of the entire Industry and occasionally are studied jointly on a cooperative basis with other companies.

The project discussed above was reported in a joint technical paper at the S.A.E. National Fuels and Lubricants Meeting in Tulsa, Oklahoma, November, 1958. Reprints of this paper are available through your Ethyl Representative, or by writing Ethyl Corp., 100 Park Ave., New York 17, N. Y.

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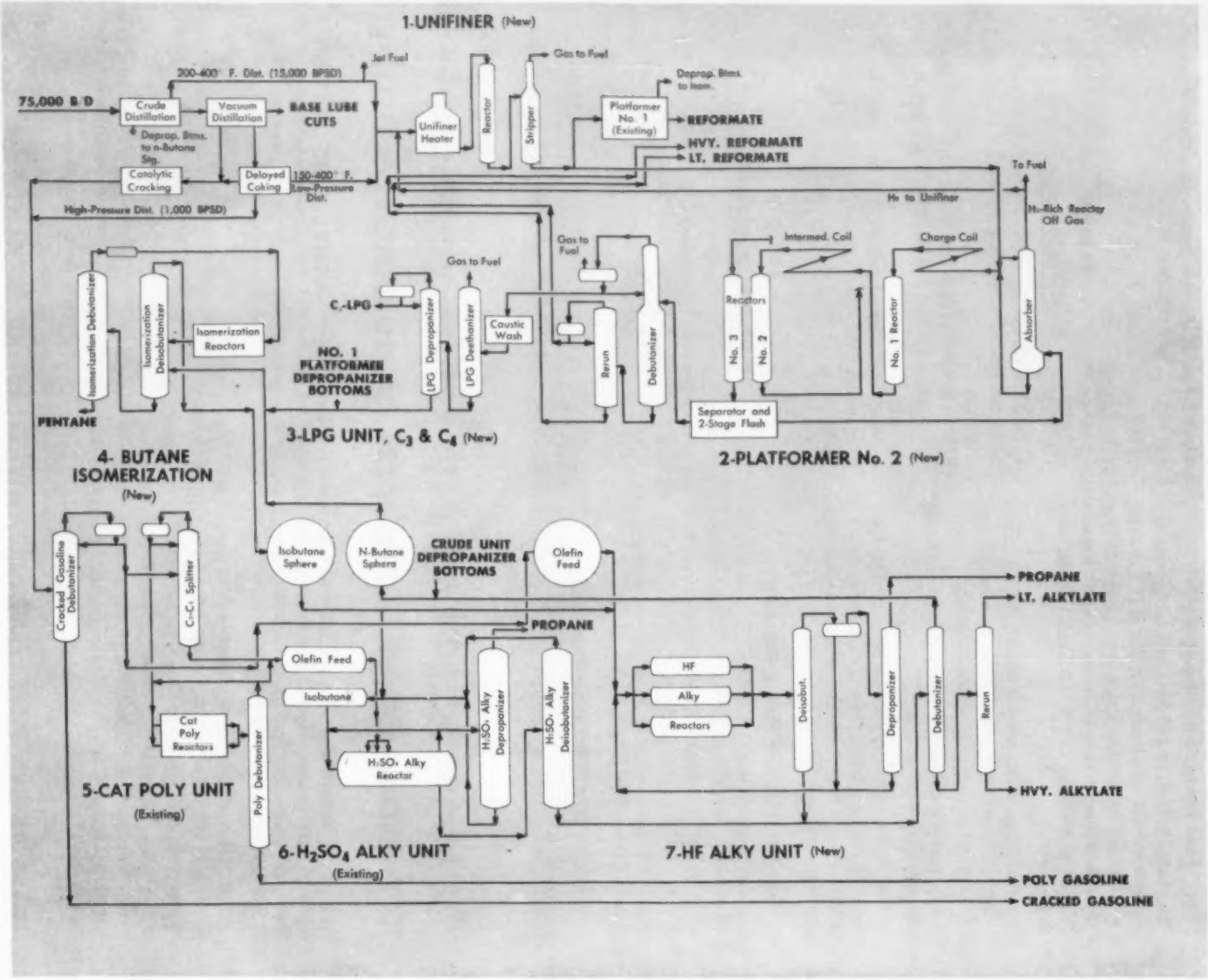


100+ octane . . . how old and new equipment were tied in

D-X SUNRAY OIL CO. Tulsa refinery is a 75,000-bbl. per day complete refinery. New units added recently are shown in flow sheet. These include a 2,400-bbl. per day butane isomerization unit and a 2,500-bbl.-daily HF alky unit. The new alky unit and the existing H_2SO_4 alky unit are balanced to make nearly 5,000 bbl. of alkylate per day.

ISOMERIZATION AND ALKYLATION units are in foreground and Unifiner and Platformer toward the back in this view of the D-X Sunray Oil Co. Tulsa refinery. A new LPG recovery unit is part of this plant's most recent expansion which now makes it possible to produce premium gasoline of 100-octane or better.

New installations at Tulsa make possible . . .

Octane flexibility for D-X Sunray

Existing H_2SO_4 and new HF alky units are balanced to make nearly 5,000 bbl. per day of light alkylate.

BY JOE H. MILLER
Chief Process Engineer,
D-X Sunray Oil Co.

INSTALLATION of new units at the Tulsa refinery of D-X Sunray Oil Co. makes it possible to produce premium gasoline of 100 octane or better. The new units recently placed on stream at the 75,000-bbl. per stream day refinery are:

1. A 20,000-bbl. UOP Unifiner.
2. New Platformer with design capacity of 12,000 bbl. daily of naphtha charge.
3. LPG recovery unit of 1,200-bbl. capacity.
4. A 2,400-bbl. butane isomerization unit.
5. HF alkylation unit of 2,500-bbl. capacity.

Tie-in of the new units with the existing cat poly and sulfuric acid alky units and with other existing units at Tulsa is indicated in the abbreviated flow sheet. This tie-in is aimed at obtaining maximum flexibility for production of octanes. The new units were licensed and designed by Universal Oil Products Co. and erected by Refinery Engineering Co.

Presently the total propylene-butylenes alky feed is split about 50-50 between the H_2SO_4 and the HF alky units. However, the alky units can be balanced for preferential alkylation of propylene in the HF unit since acid consumption is relatively high when alkylating C_3 in the H_2SO_4 unit.

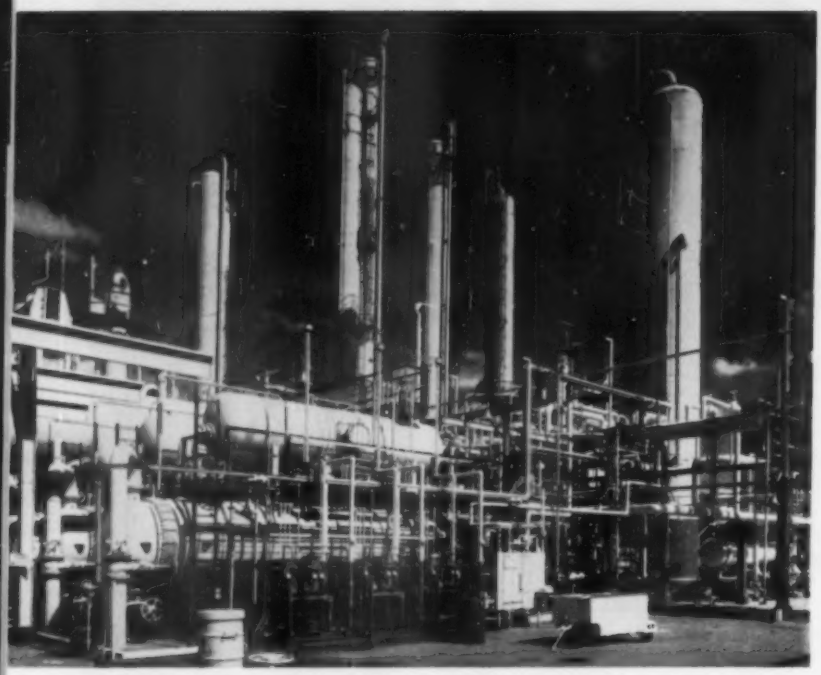
The new HF alky unit is provided with both a debutanizer and rerun column. These are used in common with the existing H_2SO_4 unit.

As in other refineries with large alkylation capacity, D-X Sunray requires additional isobutane. This is provided by isomerizing internal and purchased n-butane in the newly installed UOP vapor phase $AlCl_3$ isomerization unit.

The trend toward electronic instrumentation is emphasized once again by these new installations. All five of these units employ electronic controls. These are Swartwout systems whose basic features and performance have been dealt with elsewhere (see references).

D-X Sunray Processing

The Tulsa plant is a complete refinery. Base cuts for lube manufacture are provided by vacuum distillation. The vacuum units also prepare



HF ALKYLATION UNIT is shown here with the HF alky rerun tower at right. This rerun tower and the HF alky debutanizer are used in common with the existing H_2SO_4 alky unit.

cat cracker feed. The FCC unit has a capacity of 30,000 bbl. per day of fresh feed and operates at an average 68% conversion with 20% recycle. Cat cracker gas-recovery section is designed for recovering up to 90% C_3's. The coker has a capacity of 8,500 bbl. daily and operates with 10% recycle, making about 20% coke. Light ends from the coker are handled in the cat cracker gas-recovery system. Coker low-pressure distillate goes through the new Unifiner.

Cat cracked and coker gasoline . . . Cracked gasoline recovered amounts to about 13,000 bbl. per day. About 9,000 bbl. per day of light ends (principally C_3-C_4) is recovered. Separation is made in the cracked-gasoline debutanizer. The cracked gasoline is inhibitor sweetened, and has 98.0-98.2 RON with 3 cc. of lead. A portion of the C_3-C_4 goes directly to HF alkylation (about 35% of the total). The remainder goes to a C_3-C_4 splitter from which feed is obtained for the H_2SO_4 alky and cat poly units.

Unifiner-Platformer

Feed to the new Unifiner consists of virgin naphtha plus some coker distillate. The latter amounts, on the average, to 10% of total Unifiner feed. The 200°-400° F. boiling-range naphtha from crude distillation amounts to a maximum of 15,000 bbl. per day and the portion of this going through the Unifiner is variable, depending upon the volume of jet fuel being made. Unstabilized coker low-pressure distillate (150°-400° F. boiling range) is fed to the Unifiner at the rate of some 1,000 bbl. per day.

Unifining . . . The Unifiner is operated in a conventional manner. New charge, after combining with an H_2-rich stream from the Platformer, exchanges heat with Unifiner reactor effluent, passes through the charge heater, and enters the reactor where it contacts the Hydrobon catalyst. The H_2S formed in the presence of the catalyst is removed in the Unifiner stripper. Hydrogen is removed from reactor effluent in a high-pressure separator and low-pressure flash drum before going to the stripper. This minimizes loss of light ends in the stripper overhead.

Basic cat reform operating scheme calls for a charge rate of 12,000 bbl. per day of naphtha to produce reformate averaging 97 octane with 3 cc. on Platformer No. 2 (new) and a charge rate of 7,500 bbl. daily to produce reformate averaging 95 octane with 3 cc. on Platformer No. 1. Rerun facilities are provided with Platformer No. 2 to make a 93-octane light reformate overhead and a 100-plus octane heavy reformate bottoms in a 60-40 proportion on rerun column feed, respectively.

The new Platformer could operate blocked, if required, for production of aromatics.

Unifiner stripper bottoms are mixed with the H_2-rich recycle gas stream, heated in exchangers and direct-fired heaters and charged through the Platformer reactors. Effluent from final reactor goes through heat exchange and is cooled. The reactor effluent then goes to the product separator where it is separated into a liquid stream and H_2-rich gas stream. The liquid stream goes through high and low-pressure flash drums and then to the debutanizer.

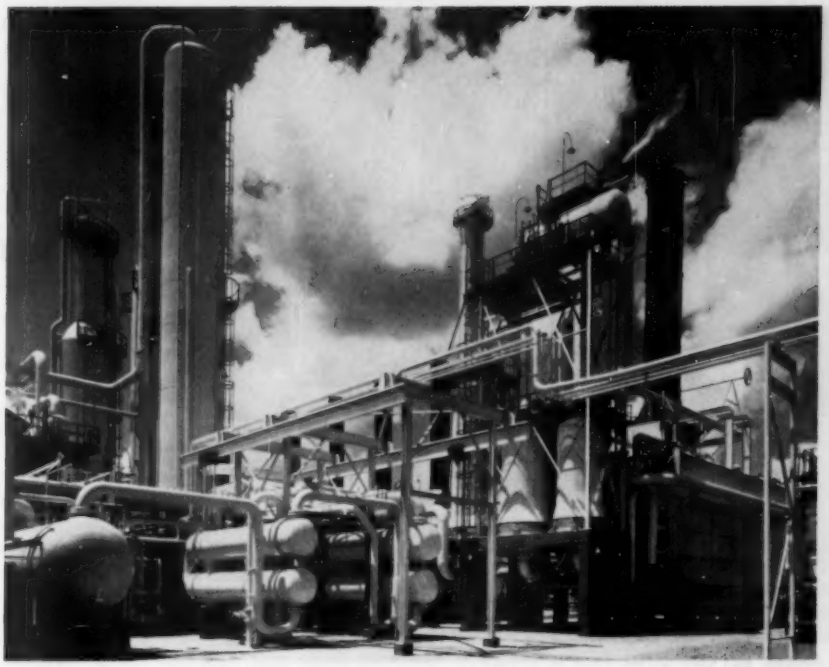
Debutanizer overhead is caustic scrubbed and goes to the new LPG unit. Debutanizer bottoms go to rerun to make light and heavy reformate. A slip stream of Platformer reactor charge is taken to the absorber en route to the reactors. This is used as absorption oil to recover heavy ends from the net Platformer reactor off gas.

Butane Isomerization

Just about all of the new isom unit capacity (2,400 bbl. per day of 99% isobutane) is needed to balance alkylation requirements. Normal butane feed comes from: (1) the No. 2 Platformer, (2) No. 1 Platformer, (3) catalytic cracking, (4) crude distillation, and (5) some outside purchases. The n-butane from cat cracking comes in with the feed to the cracked gasoline debutanizer, is carried along in the respective olefin feeds to the two alky units, and is finally separated out in the HF alky debutanizer. Crude-unit material containing n-butane goes through a stabilizer and depropanizer. The bottoms from the depropanizer are taken to n-butane storage.

Deisobutanizer . . . To obtain a high equilibrium conversion of normal to iso, it is important to keep the isobutane content of the feed at the lowest practical level. The isom reactor effluent therefore goes to a deisobutanizer whose primary function is to separate isobutane as overhead product. A secondary function of the deisobutanizer is to take overhead all water which came in with the feed so as to leave a dry n-butane bottoms product for feeding to the isom reactors. Water coming in with feed would react with the $AlCl_3$ catalyst to form alumina and HCl. Therefore, precautions must be taken to minimize loss of catalyst in this manner.

Differential temperature control . . . The deisobutanizer is provided with a differential temperature control in order to compensate for small pressure variations. This controller has an



PLATFORMER reactors, heaters, and exchangers. This is the new No. 2 Platformer at the Tulsa refinery. At full refinery capacity, Unifiner stripper bottoms are split between the two Platformers, with Platformer No. 1 (existing) acting as a balance wheel on octane production.

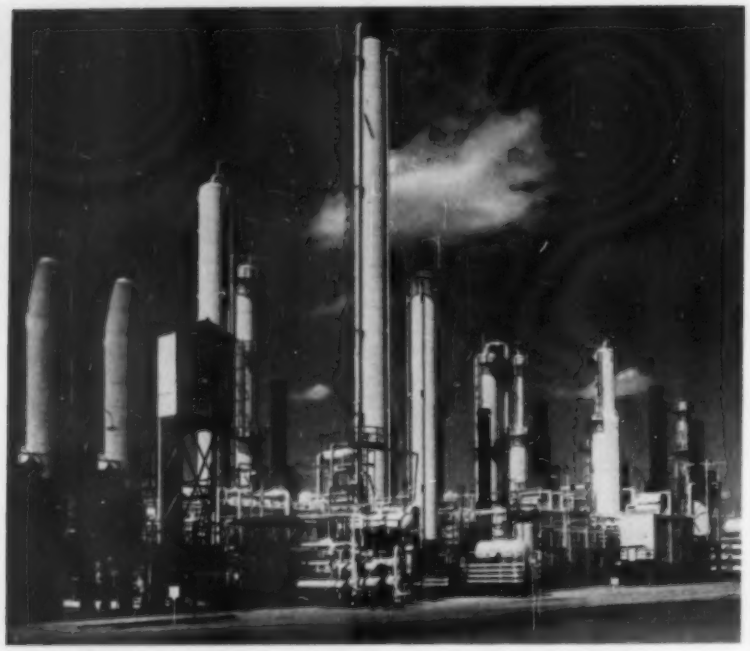
upper temperature point measuring the boiling point of 95% isobutane at any given pressure, and a lower temperature point which can be set for any purity of isobutane desired. By setting the controller for a given differential temperature (say 5° to 10° F. between upper and lower temperature), rather than a fixed single temperature, a pressure surge will not change column flows and will not upset the column. The differential control operates a control valve on reflux, making small adjustments in reflux flow to keep the column lined out.

The steam to the deisobutanizer reboiler is on flow control rather than on temperature due to presence of pentanes in bottoms. Variation in pentane content will change temperature much more than change in isobutane content; therefore temperature is not suitable as indication of isobutane in bottoms.

Debutanizer . . . Function of this column is to remove pentane from the n-butane which is recycled to the isom reactors. In the isom operation, pentanes are a feed contaminant, though to a lesser degree than olefins. A trace of pentanes can be tolerated, but larger quantities tend to form sludge. The debutanizer is designed for control of steam flow to reboiler according to the temperature measured on the thirty-third tray. This method depends on having considerable pentanes in feed to column. Where pentane content in feed is insufficient, steam to reboiler may be controlled by bottoms level and bottoms flow controlled by temperature of thirty-third tray or reboiler vapor.

There is a small amount of isobu-

ELECTRONIC instrumentation is employed on all five of the new units. This is the panel board for the Platformer, Unifiner, and LPG recovery unit.



VAPOR-PHASE BUTANE ISOM unit is shown in left foreground and isom-unit towers in back. Unifiner and LPG units are in right foreground and Platformer in right center in background. Just about all of the new isom unit capacity is needed to balance alkylation requirements.

The two alky units can be balanced for preferential alkylation of propylene in the HF unit which is provided with both debutanizer and rerun used in common with the sulfuric acid unit.

tane recycle between the isom and alky units—i.e., no isobutane is rejected at any point in the system; it is recovered in the isom unit.

Balancing for High Octane

Part of the cracked gasoline debutanizer overhead goes as olefin feed to the HF alky unit. The remainder is fed to the C_3-C_4 splitter. The C_4 cut from the splitter is the olefin feed to the H_2SO_4 alky unit. As noted, total propylene-butylenes alky feed is at present split 50-50 between the two alky units. The two units are set up to operate for maximum alkylate production over-all, but with preferential alkylation of propylene in the HF unit, as explained. If cat cracker throughput is increased, then the greater butylene production is routed to alkylation and propylene remaining above alkylation capacity goes to polymerization.

Poly unit . . . The overhead from the C_3-C_4 splitter goes to the phosphoric acid poly unit. On the poly unit, D-X Sunray gets approximately 90% conversion of olefins to poly gasoline which makes 100 RON with 3 cc. lead. When the cat cracker throughput is at 30,000 bbl. per day, the cat poly unit will make about 900 bbl. of poly gasoline. Unconverted olefins from the poly unit go to H_2SO_4 alkylation. (A portion of the poly debutanizer overhead goes to H_2SO_4 alky olefin feed.)

Alkylate production . . . A total of close to 5,000 bbl. per day of light alkylate is made at Tulsa, and with pentanes added for vapor pressure this is equivalent to 5,700 bbl. of avgas. Actually, about 2,000 bbl. per day goes into motor gasoline, on the average.

On the H_2SO_4 unit some 2,400 bbl. daily of light alkylate is obtained rated at 145 PN with 4.6 cc. of lead. The H_2SO_4 unit also makes about 150 bbl. per day of heavy alkylate and 1,000 bbl. daily of propane.

The H_2SO_4 unit is a Kellogg cascade type employing autorefrigeration. Isobutane recycle ratio is 2 to 1 coming out of reactor. Acid consumption is about 1 lb. per gallon, a relatively high consumption since operation is beyond the number of stages originally provided in this unit.

On the HF unit about 2,500 bbl. per day of light alkylate is made with an F-4 rating of 142 PN plus 4.6 cc. of lead. About 100 bbl. per day of heavy alkylate is made. Propane and butane are fractionated out in the HF unit fractionating system to recover 700 bbl. per day of propane and 100 bbl. of butane, the latter going to isom feed.

The HF alky unit employs three contactors in parallel, each having an acid settler. The contactors are the horizontal mixer type with double shaft seal. Operation is at an isobutane recycle ratio of 8 to 1. Acid consumption is 0.3 to 0.4 lb. per barrel total alkylate.

Bottoms going to debutanizer are on level control. Column pressure is regulated by the flow of bottoms to reboiler heater. There is a temperature control on the heater discharge, but this is not used for controlling the column. This control is in connection with breaking down of combined fluorides in the bottoms.

Fractionation . . . Part of the HF deisobutanizer overhead goes to the HF reactor effluent depropanizer. Propane and HF go overhead and isobutane recycle comes off column as bottoms. A hot-vapor bypass control is employed on the depropanizer overhead. Heat to reboiler is controlled by temperature in column. Deisobutanizer bottoms, together with H_2SO_4 alky unit effluent, flow to the debutanizer. Flow of steam to debutanizer reboiler is regulated according to temperature in the column to make desired vapor pressure alkylate. A hot-vapor bypass pressure control is employed overhead. The function of the rerun column is to fractionate the alkylate, making an overhead product of not over 330° F. A slip stream of the rerun bottoms (heavy alkylate) is taken to provide flush for the pumps.

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New charts determine separator capacity

Tedious calculations of oil-and-gas-separator capacities are eliminated by the charts shown on the next four pages

BY VERNON SMITH
President, Oil Metering & Processing Equipment Corp., Houston

INTENDED for use with cylindrical, monotube, two-phase separators, both vertical and horizontal, these charts are a reliable means of determining capacities of conventional oil and gas separators.

Reliability of these curves has been verified by field tests. Capacities shown are conservative for most field conditions.

Until recently, in oil and gas separators, major emphasis was placed on the separation of liquid mist from the gas, with the removal of gas from the oil receiving a lesser amount of consideration. Modern field handling of crude oil, which requires metering of large quantities of crude oil for royalty and tax payments, demands that all extraneous and nonsolution gas be removed from the crude oil prior to metering, in order to achieve the required accuracy.

Adequate retention time is required to accomplish this degree of separation of gas from oil. Retention time, therefore, is of primary importance when selecting the proper size separator. If foaming oil is encountered, required retention time may be increased from three to six times above that required for nonfoaming oils. The increase in retention time is proportional to the foaming tendency of the oil. In metering foaming oil, the need for this increased retention time is eliminated when a separator is used which meters oil on a weight basis.

The oil and gas capacities shown in the curves for both vertical and horizontal conventional separators are based on a 10-ft. shell length. If the shell length of the separator is other than 10 ft., an allowance may be required to arrive at the proper capacity.

The gas capacity of a vertical oil and gas separator is directly proportional to the cross-sectional area of the separator. The gas capacity of vertical separators is not directly proportional to shell length. For instance, an increase in shell length of vertical separators from the conventional 10 ft. to 15 ft. may increase the gas capacity less than 5%. A decrease in shell length from 10 ft. to 7 ft. may result in less than a 3% decrease in gas capacity. The change in capacity is dependent on well liquids and other conditions.

The liquid capacity of a vertical separator is usually directly proportional to the depth of oil in the accumulation section of the vessel. In vertical oil and gas separators, it is normal practice for the liquid depth in the vessel not to exceed approximately one to three diameters of the vessel depending on the exact design of the separator.

The gas capacity of a horizontal separator is proportional to the cross-sectional area of the vessel available for gas flow. Thus, the diameter of a horizontal vessel and the depth of the liquid control its gas capacity. Changing the shell length of horizontal separators from the conventional 10 ft. does not greatly change the gas capacities of these separators except in special conditions, such as foaming oil.

The liquid capacity of a horizontal separator depends on the volumetric liquid-settling capacity of the accumulation section of the separator. This volumetric capacity is determined by the shell i.d., shell length and liquid depth.

Calculations of gas capacities were based on Stokes law, which can be written as follows:

$$V = K_v D^2 \frac{(\rho_L - \rho_g)}{\mu}$$

where:

- V = relative velocity of falling liquid droplets in gas, ft./sec.
- K_v = viscous resistance constant
- D = diameter of falling droplets, ft.
- ρ_L = density of falling droplets, lb./cu. ft.
- ρ_g = density of gas, lb. per cu. ft.
- μ = viscosity of gas, ft.-lb.-sec. units

The calculations assume that the liquid-gas separation is accomplished by density differences between the liquid and gas, and by proper velocities.

Net relative gas velocities were selected which would allow separation of all liquid particles 100 μ or larger in diameter. It is assumed that the mist extractors used in the separators will effect a separation of liquid particles out of the gas down to 30 μ in diameter.

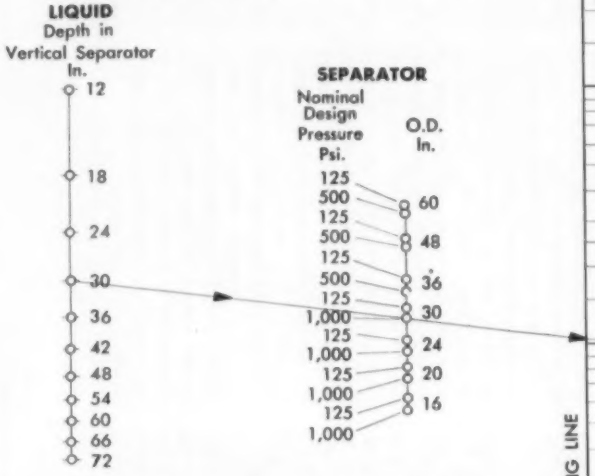
Capacities of conventional "gas scrubbers" can be determined from these curves. If knitted wire mesh is used as the mist extractor in the scrubbers, the gas capacities of the scrubbers will be about nine-tenths of the capacities given on the curve sheets for corresponding size vessels. This reduction in capacity is caused by the liquid loading of the knitted wire mesh.

The curves are arranged so that they may be used reversibly: (1) to determine the size of separator required to handle a given volume of fluids, and (2) to determine the volume of fluids which a given size separator will handle.

Use this chart to find LIQUID CAPACITY OF A HORZIONTAL SEPARATOR

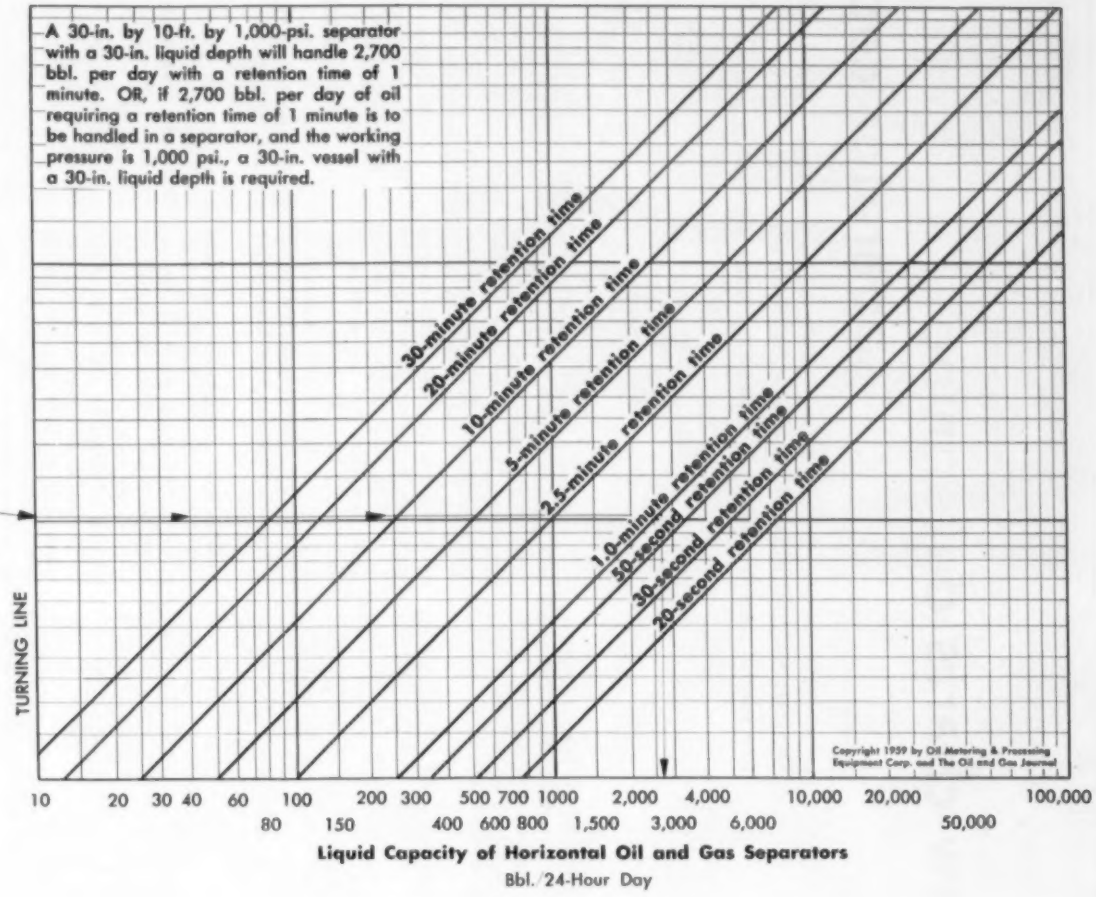
CAPACITIES ARE BASED ON:

1. Retention time indicated by parameter (see chart)
2. Steady, nonheading flow.
3. Nonfoaming oil.
4. Temperature of oil must be above pour point.
5. Oil gravity of 35° API or higher.
6. Viscosity of 50 S.s.U. or less.
7. Liquid depth in separator should not exceed approx. one to three times diameter of separator depending on exact design of separator.

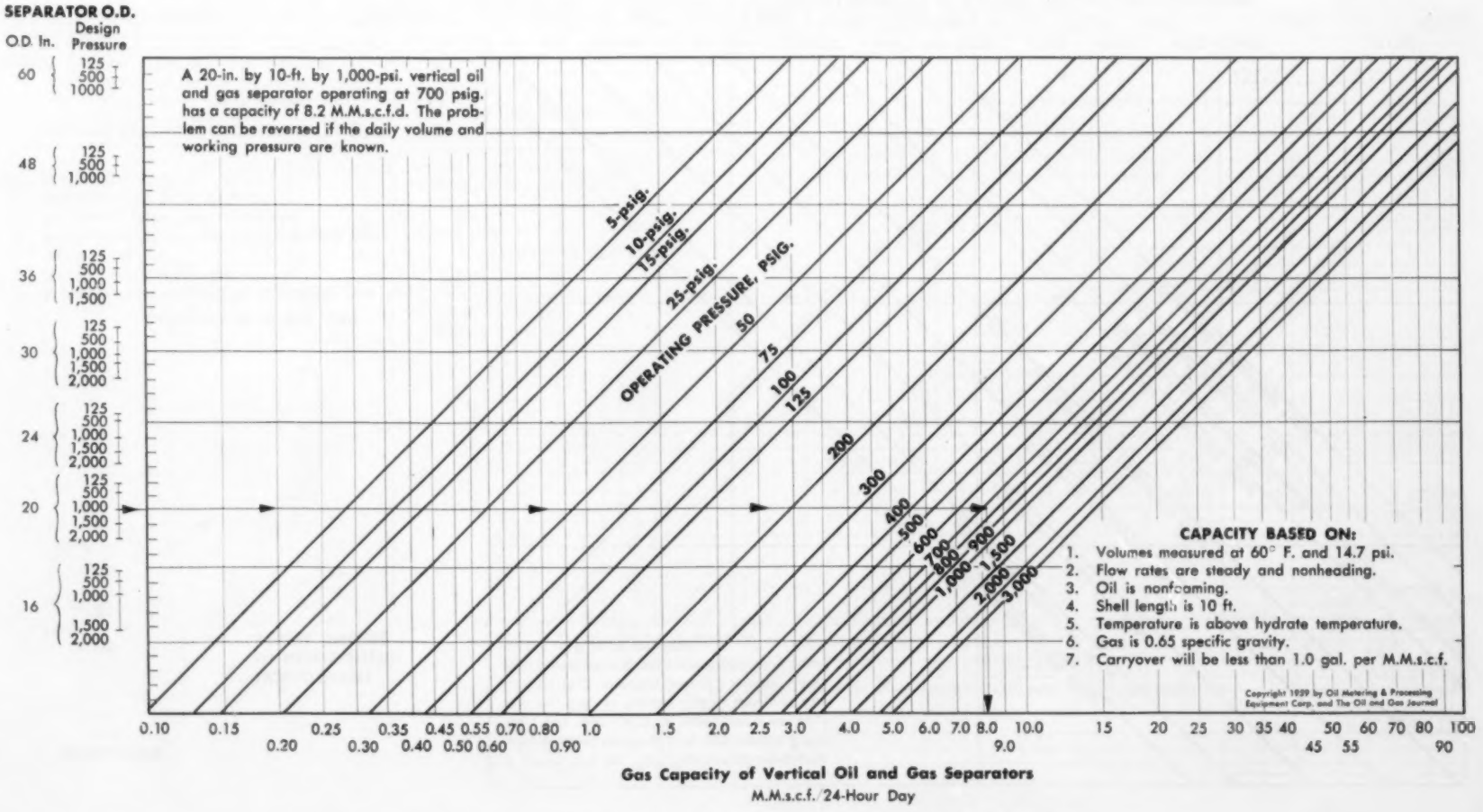


MINIMUM RECOMMENDED RETENTION TIME	
0-600 psi.	— 1 minute
600-1,000 psi.	— 50 seconds
over 1,100 psi.	— 30 seconds

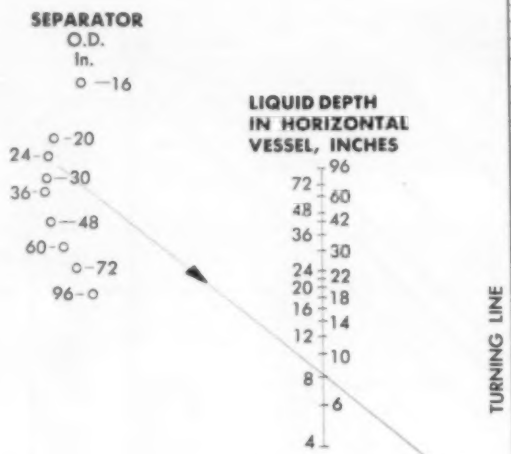
NOTE: If oil foams retention time may have to be increased to 5 minutes or more


A 30-in. by 10-ft. by 1,000-psi. separator with a 30-in. liquid depth will handle 2,700 bbl. per day with a retention time of 1 minute. OR, if 2,700 bbl. per day of oil requiring a retention time of 1 minute is to be handled in a separator, and the working pressure is 1,000 psi., a 30-in. vessel with a 30-in. liquid depth is required.
30-minute retention time
20-minute retention time
10-minute retention time
5-minute retention time
2.5-minute retention time
1.0-minute retention time
50-second retention time
30-second retention time
20-second retention time
TURNING LINE
Copyright 1959 by Oil Metering & Processing Equipment Corp. and The Oil and Gas Journal
10 20 30 40 60 80 100 150 200 300 400 500 600 700 800 1000 1,500 2,000 3,000 4,000 6,000 10,000 20,000 50,000 100,000
Liquid Capacity of Horizontal Oil and Gas Separators
Bbl. 24-Hour Day

Use this chart to find GAS CAPACITY OF A VERTICAL SEPARATOR



Use this chart to find LIQUID CAPACITY OF A VERTICAL SEPARTAOR

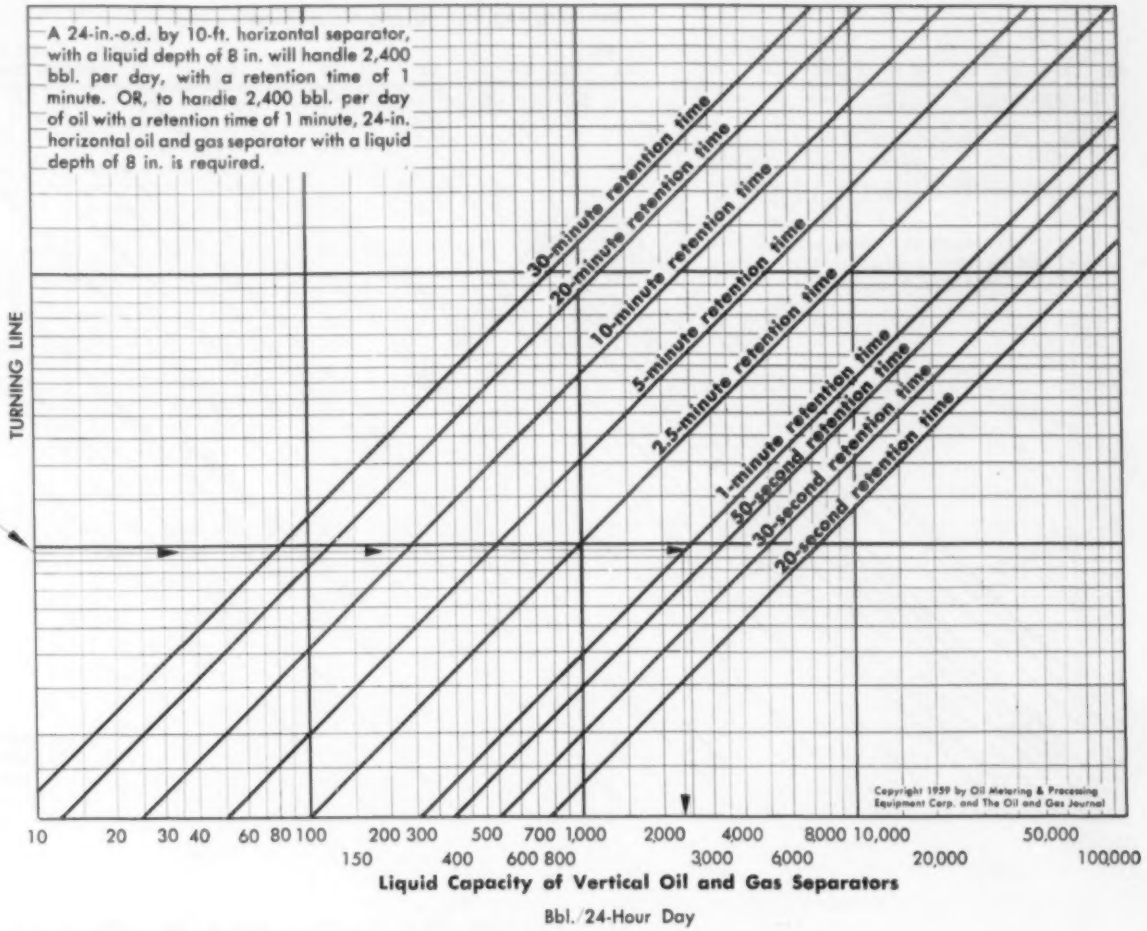


CAPACITY IS BASED ON:

1. Retention time indicated by parameter (see chart).
2. Steady, nonheading flow.
3. Nonfoaming oil.
4. Temperature of oil must be above pour point.
5. Oil gravity of 35° API or higher.
6. Viscosity of 50 S.s.U. or less.
7. Shell length of 10 ft.

MINIMUM RECOMMENDED RETENTION TIME
0-600 psi. — 1 minute
600-1,100 psi. — 50 seconds
over 1,100 psi. — 30 seconds

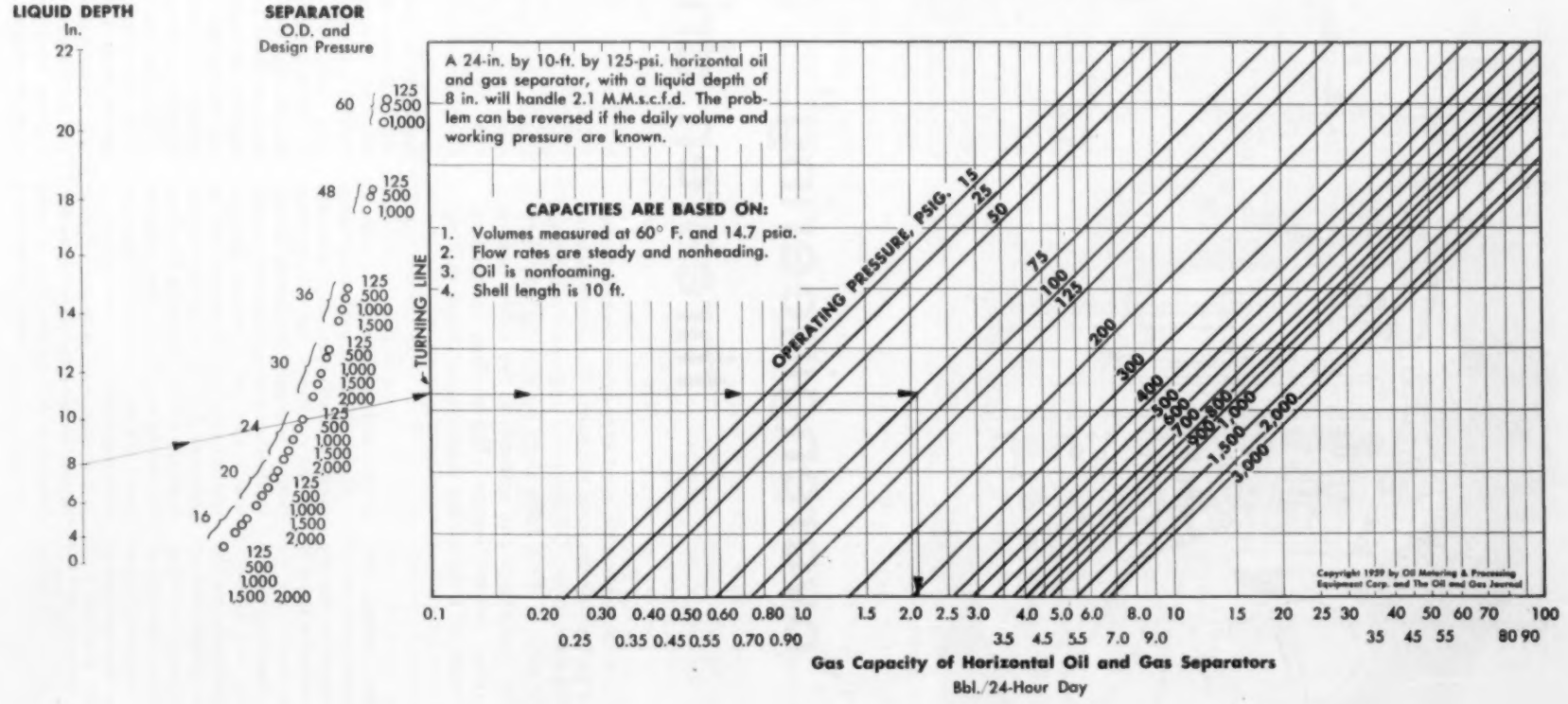
NOTE: If oil foams retention time may have to be increased to 5 minutes or more

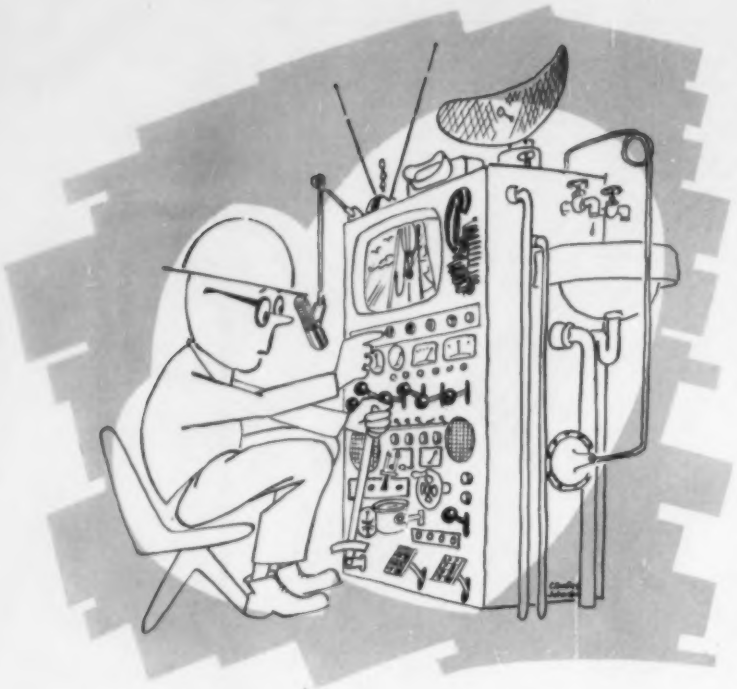


Liquid Capacity of Vertical Oil and Gas Separators

Bbl./24-Hour Day

Use this chart to find GAS CAPACITY OF A HORIZONTAL SEPARATOR





BY J. U. TEAGUE
President, Columbia Drilling Co.,
Houston

EDITOR'S NOTE—The author is a leading oil-well-drilling contractor and an engineer with many years of major-oil-company experience. He points out in this article some seeming shortcomings in today's drilling trends. No ground has been considered too sacred for critical examination. His remarks are printed here in the same spirit in which they were written—to stimulate our thinking for the benefit of all concerned with oil-well drilling.

Does "overengineering" threaten drilling?

Some of drilling's most publicized, most expensive developments turn out to be only fads or unsound schemes. These are a burden to the drilling contractor. Oil-company engineers could and should eliminate most of these false steps by making sure they are using existing equipment and methods to the fullest before recommending new, untried means. The drilling contractors could prevent much of it by doing more research on drilling methods.

UNTIL recent years, drilling contractors have relied principally on the larger producing companies and the equipment manufacturers for research in drilling methods.

This dependency is making trouble for all of us.

It seems to me that unless we the contractors assume a greater share of research, we are in danger of being overengineered. I can say this with all candor for I am an engineer by profession and major-company trained.

If the contractors don't do something for themselves, they soon will be buying pumps the size of locomotives and using three-story derrick substructures to accommodate everybody's idea of a proper blowout-preventer hookup. At the rate we are going, we bid fair to replace regular drill pipe with a string of drill collars. This might be a boon to our transportation friends, but it is a financial overload to us.

It is quite easy to be carried away by new ideas to the point where they become a fad rather than a solid permanent improvement in the art. I would seriously recommend that any new procedure be advocated with caution and only after it has been weighed with greatest care in the economic balance. The standard by which it must finally be judged is: Is it the most economical way? This may or may not be the faster way.

Specialists vs. generalists . . . Our drilling problems have become so complex that it has become necessary for engineers to specialize in various related fields. One man cannot learn all there is to know about all the various aspects of our operations. We have the mud expert, the hydraulic engineer, the equipment specialist. All are needed and all have made great contributions toward the advancement of drilling techniques.

The man we don't seem to have is the one who can tie all this information from the various specialists into a practical whole.

It is difficult for the specialized engineer who works with only one phase of drilling operations to pass

The author served as 1958 president of the American Association of Oilwell Drilling Contractors. This article is extracted from a talk before the Gulf Coast Section of Society of Petroleum Engineers of AIME, Houston, November 17, 1958.

"Can we use our drill pipe as long at these high pressures? What about rotary hose and swivel packing? The additional pump pressure may require larger engines, larger compounds, and higher moving costs. Where will the money come from to buy the new while obsoleting the still-usable old?"

reasonable judgment on the economics of his idea. The very nature of his specialized job prevents him from getting an over-all knowledge. The man interested in hydraulics naturally wants ever-larger pumps and higher pressures. He may be right on that particular phase, but can we use our drill pipe as long at these high pressures? What about the rotary hose, the swivel packing? Does all this have to be changed? The additional pump pressure may require larger engines, and in turn larger compounds and higher transportation costs for moving the heavier equipment. Then, there is the financial side: where will the money come from to buy the new while obsoleting the still-usable old?

This problem reaches beyond the contractors to the manufacturers and the suppliers who must charge more for his products to recoup the loss entailed by obsolescence of existing models and the investment in creating the new. Someone has to ultimately pay for all this.

I am the last man in the world to say we should be satisfied at any level of progress. We must ever try to do better. But, I do think we have of late been prone to go overboard without first checking a thing through in all its aspects.

Have we really come far? . . . Our progress in speeding up drilling at lesser depths has not been as great as we might think. I know of several wells drilled in the early thirties in a South Texas field with a small steam rig to a depth of just under 6,000 ft. in only 9 days. That was from the time the first piece of the rig moved on the location until the well was turned into the tanks and the last piece of the rig was off location. That is pretty good even now.

The secret was lots of water in the mud. Or, I should say, "water instead of mud," for in that case, you could read a newspaper lying on the bottom of the ditch. That was a startling discovery for its day.

By 1935 we were routinely drilling and completing 5,600-ft. wells in Tomball field in 8 days.

Where Improvement Is Needed

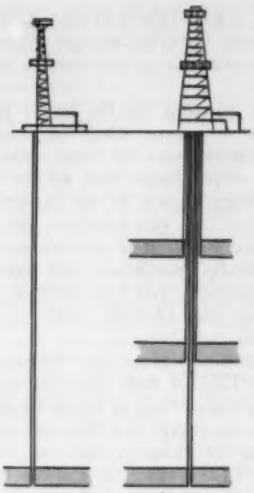
What are some of the promising areas which will bear future investigation to improve our performance? In my opinion, the same old bread-and-butter things which have lent so much to our present level of accomplishment still will stand a lot of raking over.

. . . Drilling fluid. The first of these is drilling fluid. To my mind, improved drilling fluid has been the key to faster, deeper drilling. It still is. We need to find out why clear water permits faster drilling in soft or hard formations than does mud. We know it does, but why?

I'm told that air used as a drilling fluid permits even faster drilling in hard-rock country than does water. Why? Why does the addition of oil to a low-filtration mud permit faster drilling?

It seems to me that there is still an endless frontier to explore even though we have come a long way. What happened to our old heaving shale? The formation which we could not drill just a few years back. Now, in many instances, it's a zone you look forward to because it drills fairly easily.

. . . Hydraulics. Then there is this thing of hydraulics, which really came to our attention with the jet bit. It is still in a state of flux. I recall that just a few years ago, many drilling engineers advocated that you must have 180 to 220 ft. per minute minimum velocity in the annulus between the walls of the hole and the drill pipe. With any less, they said, you couldn't properly move the cuttings from the hole. Hydraulic systems were designed around this figure.



"There is a divergence of opinion between the advocates of slim hole and the advocates of multiple completions. One wants to drill a lot of small wells. The other wants a lot of small completions in a large hole. It is puzzling to the contractor which size equipment to buy."

Contractors who had smaller pumps and couldn't get larger ones wanted to get in the swim and jet drill. They put small liners in their pumps to get the pressure that everyone else had. Sure enough, these contractors drilled just as fast as the bigger rigs. They did this although published information told them they couldn't. So, 100 to 125 ft. per minute was proved to be enough rising velocity.

Now, if the people who set the 180 to 220-ft. minimum velocity had thought longer before speaking, the purchase of a lot of oversize equipment could have been avoided. If they had considered the annular velocity which occurs while drilling the surface hole, when the largest volume of material is moved in the shortest time, they would have learned what the small contractor in his ignorance found out—that quite low annular velocities are satisfactory.

A proper design of the hydraulic system is essential to the most efficient drilling rate. But, what is proper can titillate a lot of minds with an investigative turn for some time to come. I would suggest working to make the best use of what we have.

. . . Pumps. The past few years have seen our industry go off on a pump-buying binge. First it has 700 hp.

Then, a 1,000-hp. and now 1,250-hp. and even 1,500-hp. pumps are talked. These new pumps are terribly expensive.

The demand for the larger pumps comes at a time when our industry is at its lowest ebb financially. We can't afford them. But, do we really need them? Look at the examples in Table 1. As you can see, the only instance where it is possible to apply a 1,000-hp. pump and still have surface pressure you can tolerate, is in drilling the 12¼-in. hole at great depths.

The only place in the country where 12¼-in. hole is carried so deep on a regular basis is South Louisiana. You see, except for this one section of the oil country, the old standby C-350's, 218, and 220-P's can do the job well.

. . . Slim hole. We still have virtually an untouched field in slim-hole drilling. We will, without doubt, see an increase in the drilling of slim holes. One of the main stumbling blocks now is that no one knows exactly what a slim hole is. I find that it is usually a hole too small to use my drill pipe. Six-and-three-quarter-inch holes are quite common now and even 4¾-in. are being attempted.

To meet the requirements different operators place on slim-hole drilling, the well-equipped contractor would have to have probably three strings of drill pipe: 2⅞-in., 3½-in., and a string of 4-in. o.d. Of course, if the contractor is really uptown, he will need at least one string of drill tubing too.

One major company has experimented with 5½-in. drill pipe in 7¾-in. hole, also one contractor I know of. They have been getting some very fast rates of penetration. Unfortunately, the major company lost its string on the second or third well. The contractor I'm sure has not lost his pipe as he was still in business at last account.

The slim-hole and casing programs offer economics which are most attractive to the producer. But, there is a divergence of opinion between the advocates of slim hole and the advocates of multiple completions. One wants to drill a lot of small wells. The other wants a lot of small completions in a large hole. It is puzzling to the contractor which size equipment to buy.

Weight and rotary speed . . . The study of weight versus rotary speed as it affects penetration rate is a natural for the contractor to do himself. Even he knows the harder you mash the faster you drill and the faster he turns with a given mash the faster he drills. He learned that in the old wooden-derrick days when you had to drill holes in the floor sills with a brace and bit.

Our drilling committee plans to dress that up a bit and put out an engineering treatise. We already have the curves and tables to make the report look official. The gist of the report will be: "Mash and turn fast for more hole."

Drilling Contractor of 1959

Drilling contractors have rendered a worth-while and essential service or the producing companies would not have delegated the drilling of their wells to them. More and more producing companies are finding it to their advantage to dispose of their own rigs and depend on contractors to do their drilling. At the prices we charge, how could they do otherwise?

The drilling contractor now owns the large majority of the drilling equipment available to the industry and their organization comprise the largest pool of drilling know-how available. I do not think this trend will be reversed.

The rapid expansion of an industry is always beset with growing pains and severe adjustments. During the recent boom years, the producing companies drilled too many wells, and we contractors in an effort to meet our customer's demands bought too many rigs. After the present recession set in, the oil companies found their business declining to the point where a substantial reduction in their drilling program became necessary. This left the contractors with far more rigs available than there was work to employ them.

Our business became extremely competitive and prices have declined far below the level which permits replacement of worn-out equipment. This condition cannot and will not continue forever. The harsh laws of economics will force the weak and imprudent from business. Then, it will stabilize. Those who survive will emerge wiser if poorer.

Change in contractors . . . The drilling contractor has historically taken pride in his "rugged individualism." He was thoroughly convinced that he had the best rigs, the fastest crews, and could drill the fastest hole of any contractor in the business. He was naturally a hell-for-leather fellow.

A generation ago he was all of that. There weren't too many of him, the wells he drilled were simple and shallow, and the rigs he bought cost less than a modern slush pump does today. About all he needed, or in many cases had, was the technical know-how to drill a well, plus the courage to strike out on his own. He could make a fortune and still think "viscosity" was the name of a patent medicine.

Now all that has changed. The contractor has been forced into a period of self-examination. His whole environment has changed. The actual know-how of drilling, which was once virtually his sole stock in trade, must share equally in importance with the dry, unromantic routine of everyday business. Now he must concern himself with accurate accounting systems, employe benefits, taxes, and financing.

1940 versus 1959 . . . There are tales of contractors of a generation ago buying a rig out of a field supply store's stock and of him paying for it out of the first two or three wells he drilled. A prudent contractor knows that a rig bought today will take years of work to recapture the investment. He plans accordingly. He is learning but he is paying dearly for the knowledge.

The organization of the American Association of Oilwell Drilling Contractors some 18 years ago was evidence that the more enlightened contractors recognized that the days of the rugged individualist, as much as we admired him, were coming to a close. He needed a forum for the exchange of ideas, and a device whereby he could act in unison in matters of common interest.

It is interesting to note that the by-laws of the AAODC state that its primary function is to devise methods for training its members. The men who founded the organization recognized that the contractor was entering a new day when, if he were to exist, he and his people had to be trained

TABLE 1

In each case, rising annular velocity is approximately 125 ft. per minute. Drill collars are 6¾-in. o.d., 3-in. i.d., and 360 ft. long. Bits have three jets. Mud weight is 10 to 10½ lb. per gal.

Depth (ft.)	Hole size (in.)	Drill-pipe size (in.)	Circulation rate (g.p.m.)	Bit-nozzle size (in.)	Jet velocity (ft./sec.)	Pump pressure required (psi.)	Pump input horsepower required
9,000	8¾	4½	290	3/8	280	1,180	235
10,500	9⅞	4½	395	13/32	325	1,790	486
11,000	12¼	5	635	1/2	346	2,390	1,040
15,000	8¾	5	260	3/8	251	954	170

Based on tables published by Hughes Tool Co. Figures are typical of Gulf Coast wells.

as capable business men as well as skilled specialists in drilling.

Our association has done this in a most excellent fashion. Our accounting manual is accepted world wide as the standard for determining drilling costs. Our mud-treating schools are attended by company men as much as by contractor personnel. Our drilling school of technology, held twice each year in Odessa, has students from all over the world.

Our association works very closely with the API on many of its projects. Our drilling-practices committee which investigates the problems of drilling techniques has many oil-company personnel, members of API, as members. At the present, we have subcommittees investigating air drilling, effect of weight and speed on rate of penetration, slim-hole drilling, and hydraulics.

This is as it should be. As the responsibility for drilling passes more and more into the hands of the contractors, we should contribute more and more to the advancement of our art. We must take the lead in improving our methods and increasing our efficiency to give the industry the most for its drilling dollar.

Drilling contractors must assume a greater share of research in drilling methods, either as individual companies or through their association. I'm convinced that the industry will see the contractors do just this. Most of the larger contracting firms are hiring or have hired drilling engineers on their own, and the smaller ones are beginning to.

BOOKS

THE ADVANCES IN PETROLEUM CHEMISTRY AND REFINING. Vol. 1. Edited by Kenneth A. Kobe and John J. McKetta, Jr., University of Texas, Austin, Tex. Published by Interscience Publishers, Inc., 250 Fifth Avenue, New York 1. 641 pp. $13.50.

The petroleum and petrochemical industry has taken the fundamental knowledge of chemistry and chemical engineering and transformed itself from a simple processing industry for fuels and lubricants to an extremely complicated process industry. To record these advances the editors will present at annual intervals a collection of progress reports written by leading authorities on particular subjects, of which this is the first volume.

The industry is divided into five main sections: (1) Economics and future trends; (2) Unit operations and design; (3) Refining processes; (4) Petrochemicals; and (5) Mechanical equipment.

Each year the editors will choose pertinent topics from each of the different sections. The editors are assisted by a 16-man advisory board of industry experts.

Typical topics in the current volume are fuel trends, separation and purification by crystallization, alkylation of paraffins, solvent refining, the oxo process, solid polymers from surface catalysts, and chemical plants of the future.

ECONOMIC AND SOCIAL IMPLICATIONS OF AUTOMATION: A BIBLIOGRAPHIC REVIEW. By Gloria Cheek. Published by Michigan State University Press, East Lansing, Mich. 125 pp. $1.25.

This 125-page bibliography provides a comprehensive guide to the pertinent literature printed on social and economic effects of the process of automation.

It was originally undertaken to assist staff members of the Labor and Industrial Relations Center at Michigan State University, but as the volume of books, articles, conference reports, speeches and other materials on automation and advanced technology became disproportionate, a study was made to select the most valuable references in the field.

The basic criterion used in selecting items was whether they were concerned with the economic and social implications rather than the purely technical aspects of automation. Annotations are more complete than is usual, and many nonannotated items are included.

There are some 600 items in the review, divided into 10 sections. There are two parts to each section: annotations, and nonannotated listings.

The 10 sections covered were: general; manpower and employment; society and government; selection, training, and job requirements; human relations; collective bargaining; management organization and planning; office automation and white-collar workers; case studies and company experience, and bibliographies.

"LET'S TALK ABOUT PETROLEUM." By James O. Kemm. Published by The Mycroft Press, 2043 S. Scenic Drive, Springfield, Mo., at $5 clothbound, $3 paperbound.

Far too many persons in the oil business in one capacity or another don't know much about their industry. For this reason, they are unable to defend it against outside critics. And all too often they do a poor job of selling their employer's products. This new book was written to fill that need. Himself an ardent petroleum missionary, the author seeks to convey to his readers the same pride that he feels in his industry's accomplishment. He doesn't preach; he talks facts about the drama of oil.

James O. Kemm is executive manager of the Oklahoma Petroleum Council. For 6 years previous to assuming his present position he was a district representative in Kansas City and Tulsa for the American Petroleum Institute.

Kemm's book is addressed to all who are in the marketing end of the oil business, from major oil-company executive, through marketers and consignees, to tank-wagon drivers and service-station men. He pays special attention to public relations and selling to the farm trade. The latest developments in plus service are reported and dramatized through cases.

In the belief that no employe can do his best job for his company or local firm without knowing something of the whole story of petroleum, chapters are devoted to a plain-language account of how petroleum products have been brought out of the earth, refined, and transported to market.

PROCEEDINGS OF TECHNICAL SESSION, KENTUCKY OIL AND GAS ASSOCIATION TWENTY-SECOND ANNUAL MEETING. Available from Kentucky Geological Survey, 120 Graham Avenue, University of Kentucky, Lexington.

This publication includes 11 technical papers presented at the association's June 5-6, 1958, meeting, covering subjects on oil taxation, bank financing, oil and gas pools and developments, stream pollution, oil and gas operations in coal-bearing areas, and services rendered by the Kentucky Geological Survey to the oil and gas industry.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.

Nelson Refinery Construction Index

Appears in the Engineering Section in the first issue each month.

Compiled by W. L. Nelson, petroleum refinery consultant, Tulsa.

The Index was explained October 1, 1956 (page 110) as well as the Indexes of Individual Items of Equipment that appear on the Costimating page in the first issue of the months of January, April, July, and October.

	Index (1946 = 100)					
	1950	1954	1955	1956	1957	Sept. 1958
Pumps, compressors, etc.	138.2	166.5	172.2	192.0	206.7	212.4
Electrical machinery	134.9	160.0	162.5	175.0	188.9	193.6
Internal-combustion engines	126.0	150.5	153.2	164.0	173.9	178.9
Instruments	127.8	154.6	162.9	182.1	187.4	197.0
Heat exchangers	140.0	171.7	156.8	190.7	203.6	174.2
Misc. equipment average	*126.2	160.7	161.5	180.5	192.1	191.4
Materials component	149.5	174.6	176.1	190.4	201.9	205.6
Labor component	144.0	183.3	189.6	198.2	208.6	223.6
Nelson construction index	146.2	179.8	184.2	195.3	205.9	216.4

*Used in computing the Nelson Index until April 1952. This is slightly different from the average of the Miscellaneous Equipment Items shown above. †Preliminary.

NEW International® Drott with Four-In-One

CAPACITY... to outload 100 hp "single-action" rigs

PLUS VERSATILITY UNLIMITED... of exclusive clam-action

Sized, powered, geared, and controlled to decisively outproduce any "single-action" loader in the 100-hp field—the new 2¼ cu yd TD-15 4-In-1 gives you exclusive International Drott clamshell action!

Here's new big-job-sized versatility unlimited! Simply move the selector lever from the tractor seat with fingertip ease—to get any one of four big-capacity machine actions needed. On big job after big job, the TD-15 4-In-1 can replace costly limited-action machines one after another!

And whether this 4-In-1 replaces four or forty machine actions for you, you get it for one moderate price!

Smooth, years-proved, 115 hp 6-cylinder International diesel engine in the new TD-15 4-In-1 gives you full advantage of increased hydraulic system capacity—of new 6-speed, full-reverse transmission mobility—of new cycle-speeding forward-reverse Shuttle-Bar control!

Correct balance and long-track stability eliminate the need for counter-weighting the TD-15 4-In-1. Track length on the ground is a full 98⅜ inches!

Compare capacity and versatility on your own oil field operations!

There's only one way to size-up new TD-15 4-In-1 performance—to measure its job range and capacity—to compare its money-making capabilities to a yard-full of one-purpose rigs. That's to get on the deep-cushioned seat and prove to yourself what it can do. See your International Drott Distributor for a demonstration!

"Concrete-bucking" pry-action break-out breaks up, digs up, and loads out old pavement—gives a big profit-advantage to the contractor, over single-action rigs that lack 4-In-1 *pry-over-shoe* power! The new TD-15 4-In-1 exerts the tremendous break-out force of 42,650 lbs.

As a "carry-type scraper" with cutting edge grading-off an even layer, and "boiling" the bucket full, the new TD-15 4-In-1 gives you a multitude of profitable uses. It can grade, strip, spread, or load-in-place a wide variety of materials with amazing accuracy!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

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TD-15

You'd need a heavy-duty blade outfit to match the earth-rolling material-digging performance of the new TD-15 4-In-1! You regulate dozing depth accurately with "radius control," hydraulically, from the tractor seat.

"Back-dragging" with exclusive clamshell action—new TD-15 4-In-1 reduces time and cost of "dressing" a bank—or pulling down material by the truckload! Shuttle-Bar control speeds up back-and-forth cycles on jobs like this!

BY W. L. NELSON, Technical Editor and Petroleum Consultant

COSTimating

Itemized Cost Indexes

THE COST INDEXES may be used to convert prices at any date to prices at other dates by ratios of the cost indexes of the same date. Itemized indexes are published each quarter (first weekly issues of January, April, July, and October). In addition, the Nelson Construction Cost Index is published in the first issue each month of The Oil and Gas Journal.

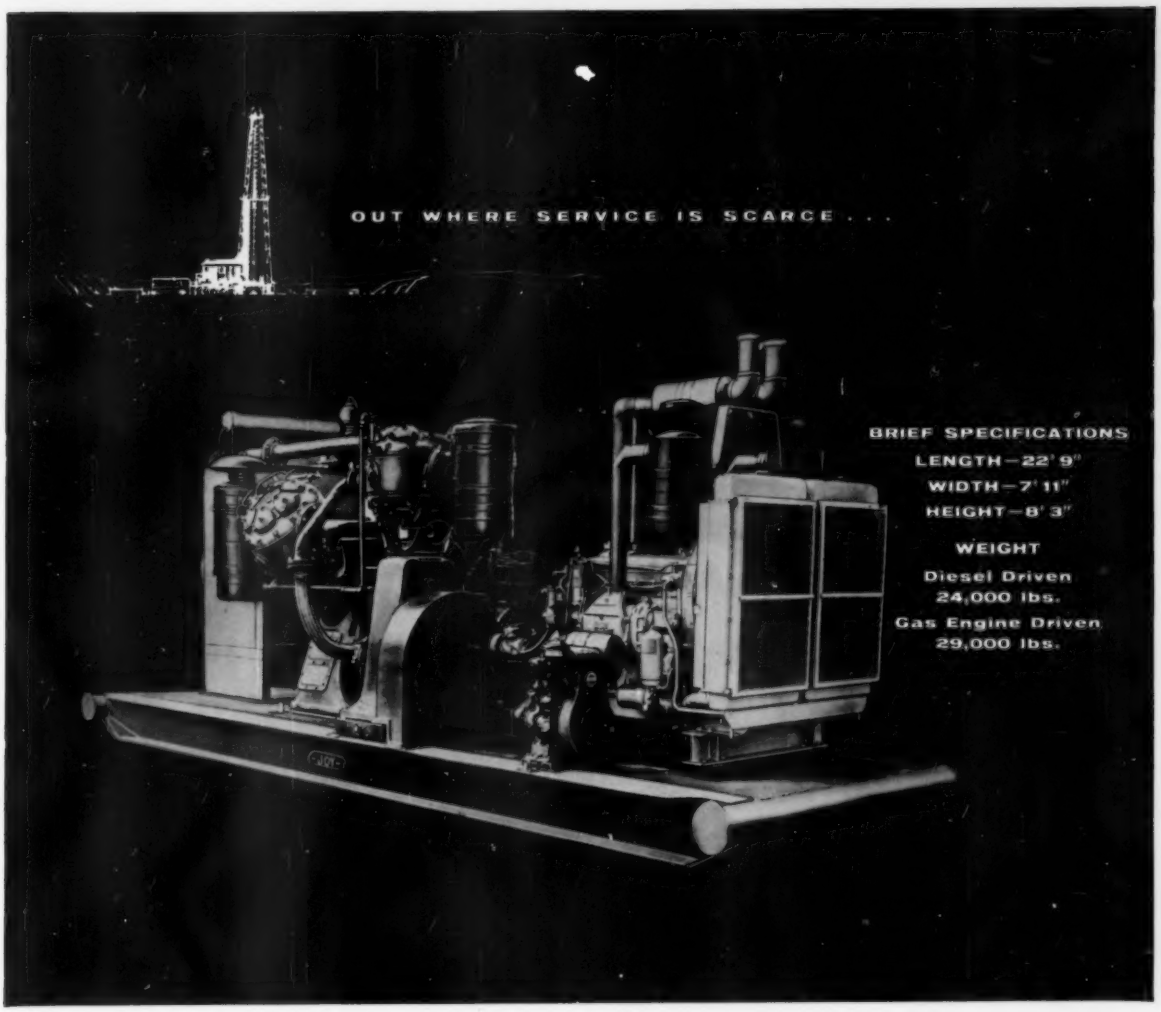
	1949	1952	1954	1956	1957	Aug. 1958	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Technology issues
Operating costs (based on 1956 as 100.0):								
Power, electric, industrial	¶97.6	¶97.9	¶98.5	100.0	¶101.3	103.8	Code 540-03	
Fuel, residual	66.0	81.0	86.5	100.0	117.6	94.3		No. 4—Mar. 17, 1958
Gulf cargoes	69.5	78.3	85.9	100.0	123.8	105.1		No. 4—Mar. 17, 1958
N. Y. barges	69.6	84.9	82.6	100.0	112.3	93.5		No. 4—Mar. 17, 1958
S. Pedro bunkers	76.9	79.8	84.3	100.0	129.2	110.6		No. 4—Mar. 17, 1958
Oklahoma	51.2	57.1	62.0	100.0	105.3	68.0		No. 4—Mar. 17, 1958
Fuel, natural gas, wellhead	58.3	72.2	88.9	100.0	101.8	120.6	Code 531-01	
Industrial chemicals	80.1	95.0	96.9	100.0	101.9	101.2	Code 61	
Phosphoric acid	86.7	93.9	96.6	100.0	100.9	103.4	Code 611-07	
Sulfuric acid	76.1	89.5	100.0	100.0	100.0	100.0	Code 611-09	
Ammonia	104.8	94.6	103.0	100.0	98.3	97.1	Code 611-13	
Lime	..	87.7	92.0	100.0	106.4	104.0	Code 611-29	
Sodium carbonate	76.7	84.5	92.9	100.0	104.3	104.3	Code 611-65	
Sodium hydroxide	73.5	80.6	90.9	100.0	103.6	115.7	Code 611-69	
Sodium phosphate	85.3	92.0	95.5	100.0	101.1	104.6	Code 611-71	
Furfural	..	93.6	100.0	100.0	100.0	100.0	Code 612-63	
MEK, drums		94.5	94.5	100.0	105.2	106.9	Ch. & E. News	
Phenol		110.6	90.4	100.0	103.2	103.2	Code 612-83	
TEL	95.9	105.4	102.8	100.0	101.5	100.0	Supplier	
Operating labor (wages)	69.5	81.5	88.7	100.0	103.9	104.5	Employ. & Earn.	No. 55—Nov. 3, 1949
Productivity	85.5	90.2	97.1	100.0	98.0	102.7	Employ. & Earn.	Sept. 24, 1956§
Construction wages (1946 = 100):								
Skilled construction	133.9	157.9	174.6	187.3	196.3	207.0	Eng. News Record	No. 55—Nov. 3, 1949
Common labor	140.4	168.2	192.1	209.2	221.0	239.8	Eng. News Record	No. 55—Nov. 3, 1949
Refinery construction	137.1	163.1	183.3	198.2	208.6	223.0		No. 61—Dec. 15, 1949
Equipment or materials (1946 = 100):								
Arc-welding machinery	130.5	151.3	158.4	180.2	186.6	194.6	Code ‡1176	May 2, 1955§
Boilers, tanks, and sheet metal	†134.8	†153.4	147.3	168.0	176.3	173.9	Code 1072	Apr. 21, 1952§
Building materials (nonmetallic)	151.2	134.8	143.6	154.0	159.9	160.6	Code ‡13	No. 22—Mar. 17, 1949
Brick-building	127.7	140.6	144.7	159.2	161.3	162.1	Code 1341	No. 20—Mar. 3, 1949
Brick—fireclay	139.8	167.1	193.1	218.1	232.7	235.6	Code 1342	May 30, 1955§
Castings (foundry products)	150.5	168.0	181.1	204.7	220.5	228.5	Code 1015	No. 46—Sept. 1, 1949
Clay products (structural, etc.)	126.0	145.8	159.1	176.9	184.0	185.9	Code 134	No. 20—Mar. 3, 1949
Concrete—ingredients	123.7	132.7	142.1	153.3	159.7	163.3	Code 132	No. 22—Mar. 17, 1949
Concrete—products	121.7	132.6	138.5	144.9	149.0	151.3	Code 133	
Electrical machinery	130.9	152.4	159.9	175.0	¶188.6	193.6	Code ‡117	May 2, 1955§
Motors and generators	128.7	154.6	157.7	169.6	181.2	187.4	Code ‡1173	No. 31—May 19, 1949
Switchgear	132.3	161.4	171.2	194.9	¶212.0	220.2	Code ‡1175	May 2, 1955§
Transformers	129.7	148.0	161.9	175.4	188.0	188.0	Code ‡1174	No. 31—May 19, 1949
Engines (composite)	124.8	146.5	150.5	164.0	173.9	178.9	Code ‡1154	No. 36—June 23, 1949
Exchangers	133.0	165.8	¶171.7	¶190.7	203.6	174.2	Manufacturer	No. 2—Oct. 28, 1948
Copper base	....	175.3	¶156.8	198.8	191.4	162.1	Manufacturer	
Steel	.. ..	152.3	¶190.7	178.6	213.2	184.4	Manufacturer	
Fans and blowers	152.2	183.7	192.6	222.4	236.1	241.5	Code 1147	Feb. 17, 1948§
Hand tools	134.0	155.1	173.8	200.3	214.3	225.1	Code 1042	June 27, 1955§
Instruments (composite)	123.1	146.2	154.6	182.1	187.4	197.0	Manufacturer	No. 34—June 9, 1949
Flowmeter (mechanical)	109.2	132.3	161.6	203.3	203.3	219.1	Manufacturer	No. 34—June 9, 1949
Flowmeter (air control)	132.4	160.5	179.6	203.9	208.2	223.5	Manufacturer	No. 34—June 9, 1949
Flowmeter (remote)	130.2	155.2	146.5	170.2	171.2	179.2	Manufacturer	No. 34—June 9, 1949
Potentiometer, 6-point	125.8	151.5	167.2	211.8	230.9	240.7	Manufacturer	No. 34—June 9, 1949
Potentiometer, air control	131.6	144.9	150.5	192.3	204.6	212.6	Manufacturer	No. 34—June 9, 1949
Pressure controller recorder	130.2	158.4	166.3	187.1	189.3	200.0	Manufacturer	No. 34—June 9, 1949
Pressure gage	100.0	108.6	108.6	119.2	119.2	119.2	Manufacturer	No. 34—June 9, 1949
Thermometer (recording)	118.6	149.4	152.8	170.2	171.8	179.7	Manufacturer	No. 34—June 9, 1949
Control valve	129.8	155.5	162.0	180.9	187.8	199.3	Manufacturer	No. 34—June 9, 1949
Lumber (composite)	165.3	203.2	197.8	214.5	201.8	200.6	Code 81	No. 7—Dec. 2, 1948
Southern pine	157.7	191.2	181.2	195.0	187.6	183.7	Code 812	No. 7—Dec. 2, 1948
Other soft woods	203.9	248.5	252.7	266.5	257.6	248.4	Code 813	No. 7—Dec. 2, 1948
Machinery—general purposes	131.9	151.8	159.9	183.8	196.5	199.6	Code 114	Feb. 17, 1949§
Machinery—construction	136.0	157.5	165.9	187.4	199.4	208.8	Code 112	
Machinery—oil-field	†132.9	†149.9	†161.9	†179.3	193.2	188.6	Code 1151	Oct. 10, 1955§
Paints—prepared	142.8	155.7	159.0	169.2	178.1	180.8	Code 621	May 16, 1955§
Pipe, sewer	†119.3	136.9	140.1	160.5	168.0	170.3	Code 1345	No. 2?—Mar. 17, 1949
Pipe, black iron	152.2	179.0	195.0	233.0	256.1	271.7	Code 1014-56	No. 19—Oct. 15, 1956
Pipe, 6-in. line	†152.0	174.0	200.5	241.2	268.3	284.5	Code 1014-58	May 4, 1957§
Pumps, air compressors, etc.	135.9	153.6	166.5	192.0	206.7	212.4	Code ‡1141	No. 29—May 5, 1949
Steel (iron and steel)	143.3	168.5	179.6	209.0	224.5	231.4	Code 101	No. 61—Dec. 15, 1949
Steel—finished steel	173.8	170.0	187.1	212.4	232.5	244.1	Code 1014	July 25, 1955§
Plate	142.1	163.1	187.0	215.9	241.8	257.4	Code 1014-26	Mar. 4, 1957§
Structural shapes	151.2	176.2	193.4	219.1	252.2	268.4	Code 1014-31	No. 18—Feb. 17, 1949
Seamless tubes, 2-2¼ in.	140.9	168.8	199.4	235.5	265.4	277.9	Code 1014-61	Sept. 5, 1955§
Valves and fittings	†132.9	190.8	197.1	231.9	243.4	244.5	Code ‡1149 (10 items)	No. 46—Sept. 1, 1949
Nelson Refinery Construction (1946)	139.6	163.6	179.8	195.3	205.9	215.9		No. 61—Dec. 15, 1949
Nelson Ref. Operation (1956)	68.2	80.5	88.7	100.0	107.0	103.2		No. 2—Mar. 3, 1958
Nelson Ref. Process Oper. (1956)	71.3	82.2	88.4	100.0	108.1	103.0		No. 2—Mar. 3, 1958

*Code refers to the revised index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices."

†Estimated base value for 1946.

‡Not exactly the same items as those published before July 7, 1952.

§Questions on Technology, The Oil and Gas Journal. ¶Revised.



THE JOY AP-2 "PACKAGE" COMPRESSOR . . . *designed* FOR AIR DRILLING

DRILLING CONTRACTORS: We found out what you had to have in a compressor to drill with air successfully . . . then we *built* it.

The AP-2 gives you plenty of air . . . 1056 cfm at 125 psi or 647 cfm at 250 psi. The AP-2 is rugged . . . takes all the abuse of day after day operation out in the open. And it has all the features you've asked for: REMOTE CONTROL OPERATION: regulated by lever controls at the drillers console. INSTANT PORTABILITY: mounted on a single, oil-field type skid—ready for over-the-road hauling. TRUE PACKAGE UNIT: Completely self-contained . . . always ready to run.

For real success with air drilling use a compressor *designed* for air drilling . . . the Joy AP-2. ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

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JOY...EQUIPMENT FOR THE OIL FIELDS . . . FOR ALL INDUSTRY

WRITE FOR FREE BULLETIN 171-31

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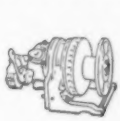
Portable Safety Lighting


Portable Hoists

Shot Hole Rigs

HALF CENTURY OF DRILLING RESEARCH HAD ITS BEGINNING IN A UNIQUE LABORATORY

THE LIGHT that shone from the door of the first Hughes research laboratory was dim indeed compared with the blaze of light that shines today, a half century later, from the block-long Research and Engineering Laboratory in Houston, Texas.

That first laboratory was housed in a small wooden derrick, erected alongside the company's first plant. Corrugated iron enclosed the lower part of the derrick. Ivy and moon flowers covered most of the structure. The machine set up in the laboratory to simulate rotary drilling was steam-driven. The holes it drilled in blocks of rock made possible the first analysis of the performance of rock bits.

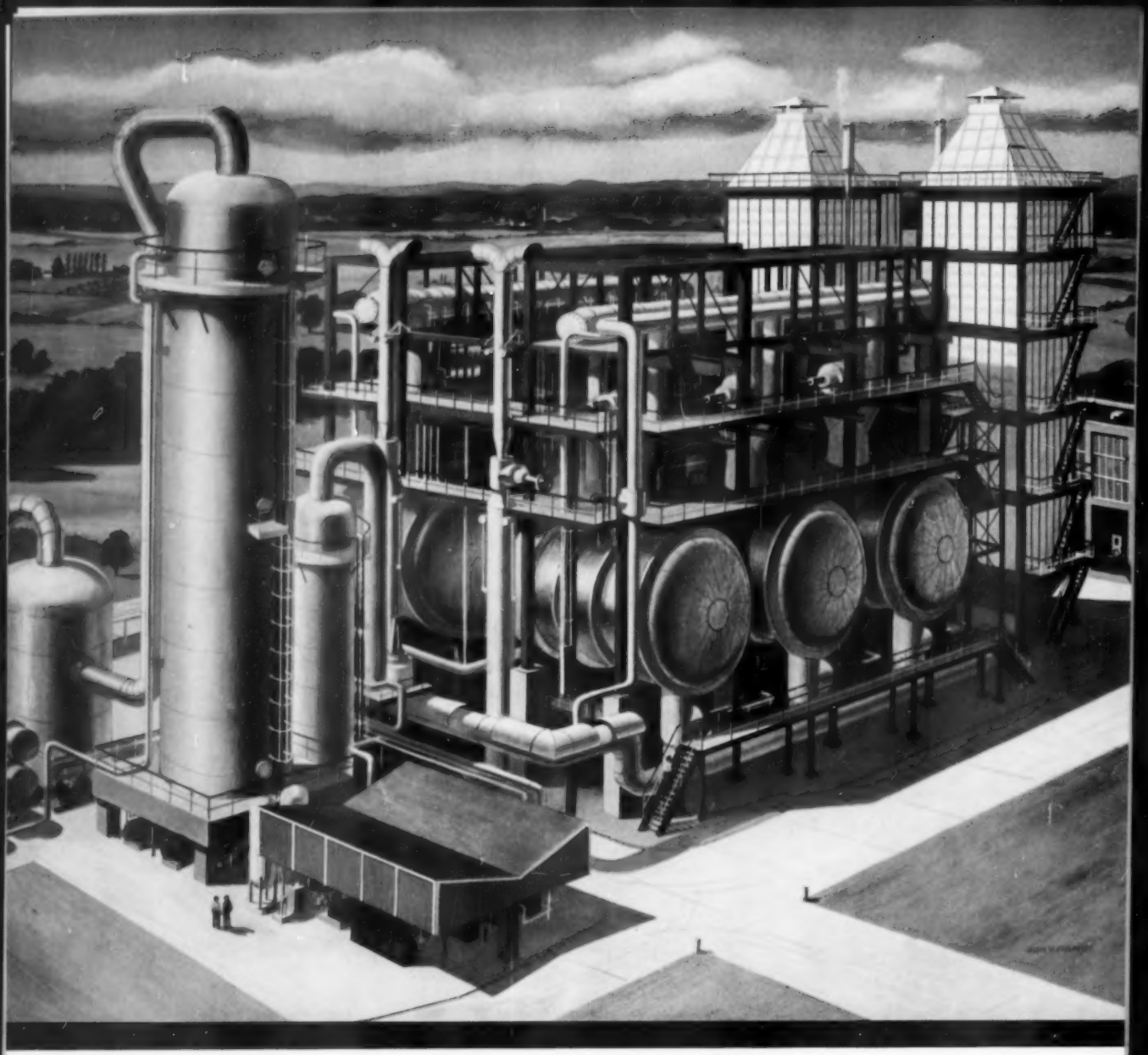
Research started 50 years ago has continued without interruption and has grown from year to year. For many years, the only drilling research being done was that carried on by Hughes. And in those early years of rotary drilling, oil companies frequently used the Hughes research laboratories for metallurgical, chemical and physical analysis of materials.

The present two-story Hughes Research and Engineering Laboratory building, built in 1952 and further enlarged in 1958, houses the largest drilling laboratory in the world. But the policy that guides its operations is the same as that set forth at the start of Hughes research: "never to be satisfied . . . and to continue to anticipate the ever-changing requirements of the drilling industry."

BIRTHPLACE OF DRILLING RESEARCH

In the painting at the left, the artist, in this night scene, has attempted to capture something of the loneliness and mystery of the work carried on in the first Hughes laboratory. Enlarged prints in full color are available for the asking. Write: Advertising Department, Hughes Tool Company, P. O. Box 2539, Houston, Texas.

HUGHES TOOL COMPANY



ONE STEP BUTADIENE PRODUCTION IN WEST GERMANY

Bunawerke Huels G.m.b.H. is the first foreign processor to use the flexible, single-step Houdry Dehydrogenation Process. This new plant, at Marl, Kreis Recklinghausen, West Germany, converts refinery butane to butadiene using Houdry-developed dehydrogenation catalyst. Nominal capacity is 36,000 metric ton/yr. Houdry process design also allows easy adaptation to efficient and economical production of butenes and other olefins, should it become desirable.

A full description of this exclusive Houdry Process and its advantages, with complete technical information, may be obtained from: Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa.

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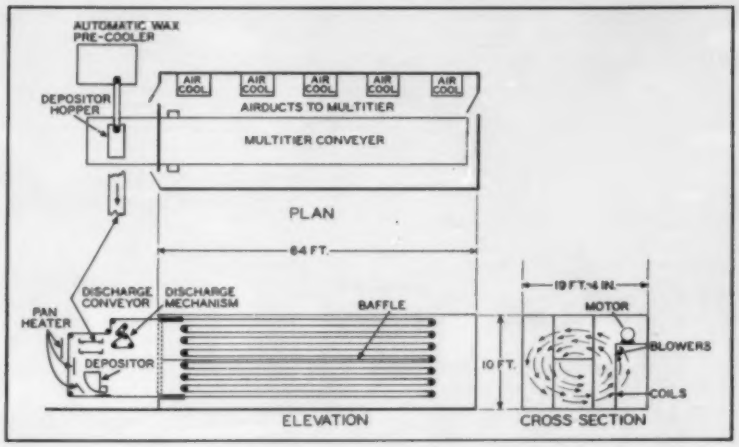
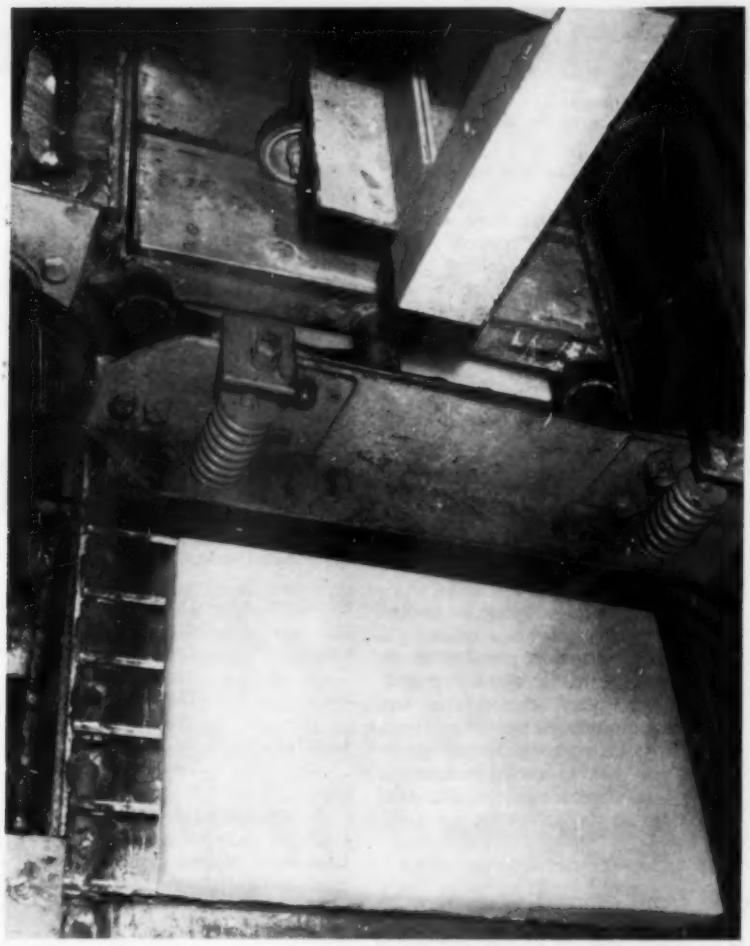
*Houdry means Progress . . . through Catalysis



With this machine design . . .

Less moisture means faster wax-cake molding



WAX CAKE being dumped from an inverted pan passing under a flexible roller. Cake at bottom of picture is on conveyor going to automatic packaging.

BY S. F. KANDRA AND W. D. MANZ, JR.
Magnolia Petroleum Co.,
Beaumont, Tex.

MOISTURE CONDENSATION on wax cakes during continuous molding operations has been eliminated by the Magnolia Petroleum Co..

This was done by silicone coating the molding pans, preheating the pans before filling, and by minor equipment changes. Wax cakes can now be demolded at temperatures above the dew point of the surrounding air. Since the higher wax-cake temperatures allow reduced cooling time and increased conveyor-belt speed, production rates have been increased 15%.

Condensation of moisture on the surface of cold wax cakes had been a recurring problem. This condition was undesirable for two main reasons:

1. Packaging of wet wax in cardboard cartons was unsatisfactory.
2. Moisture on the wax interfered with some consumers' operations.

Wax Molding

A look at the molding operation explains why wax-cake temperatures were frequently below air dew points. Magnolia, in its slabbed-wax production, uses a molding machine manufactured by the J. W. Greer Co. of Cambridge, Mass.[1 2 3 4 5 6] As shown in the schematic diagram, molten wax is first pumped through tempering exchangers where its temperature can be adjusted in either direction. The wax is then fed to measuring pistons which empty into stainless-steel molding pans. The 2,508 pans move on a continuous chain conveyor through a cooling chamber where the chain travels a distance of about 800 ft. in a space 64 ft. long and 10 ft. high. Refrigerated air is blown over the wax which solidifies and emerges as 11-lb. cakes. The cakes leaving the chamber are automatically discharged from the pans and sent to packaging equipment. Satisfactory performance of the entire molding operation depends upon successful demolding of the wax cakes. Failure of one cake to demold automatically stops the equipment. Cake temperature is the primary operating variable used to control demolding characteristics.

Condensation Problem

Summertime dew points in the Gulf Coast area range in the mid-70's. The temperatures required to insure that

OVER-ALL VIEW of molding operation. At left is cooling chamber. In background is cake inspector. At right center is automatic packaging machine. At right along wall is conveyor to loading platforms.

wax would demold freely from the pans were usually below the dew point of the air. Condensation was excessive, especially during the frequent periods of high humidity.

Two approaches to the problem were considered:

1. Air-conditioning to reduce dew point of molding room below cake temperature.

2. Modification of molding equipment to permit demolding at cake temperatures above the atmospheric dew point.

Plans for air-conditioning the building housing and molding equipment were developed for analysis and estimation. Both dehumidification and dehumidification with cooling were considered.

Equipment modifications and molding variables were evaluated in the process-engineering laboratories at the Magnolia refinery. The items selected for study were:

1. Plastic coating of wax pans.

2. Temperature of unfilled wax pans.

3. Temperature of wax used to fill pans.

A silicone material was selected from among several possible compounds for testing as a release agent in the molding pans. The pans were acid-etched to obtain a better bonding surface and the coating was baked after application.

Evaluation of Demolding Characteristics

The following procedure was developed to evaluate demolding characteristics in the laboratory:

1. Establish pan and cooling-room temperatures.

2. Heat wax to pouring temperature and fill pan.

3. Place thermocouples in molten wax.

4. Cool with pan exposed to circulating air stream for desired period.

5. Record wax temperatures and remove thermocouples.

6. Demold wax by dropping inverted pan 4 in. to a solid surface.

7. Rate demolding characteristics according to the following guide:

SILICONE-COATED molding pans in conveyor belt frame.

Excellent	—Demolds without dropping.
Good	—Demolds after one drop.
Poor	—Demolds after two drops.
Unsatisfactory	—Will not demold after two drops.

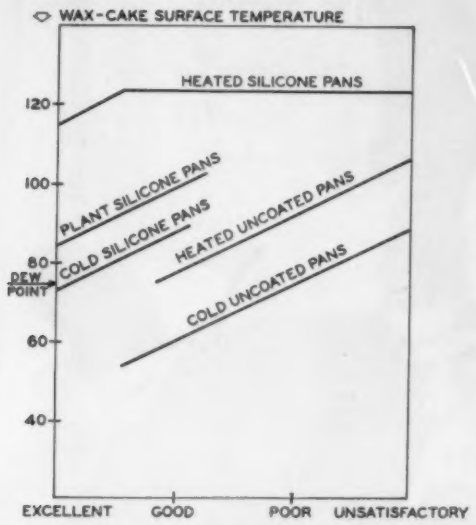
A low-melting-point grade of wax (125-127 A.m.p.) was chosen for the laboratory studies because it is the most difficult to demold.

The laboratory investigations revealed the following:

1. Coating the pans allows a 30° F. increase in demolding temperature.

"A silicone material was selected from among several possible compounds for testing as a release agent in the molding pans . . . and the coating was baked after application."

Demolding characteristics of wax . . .



EFFECT of pan coatings on wax demolding characteristics, 150° F. wax-pouring temperature.

TABLE 1—DEMOLDING CHARACTERISTICS

Pan coating	Temperatures, °F. Wax before pouring	Pan before filling	Chilled cake surface	Demolding characteristics
A	135	65	64	Excellent
A	135	65	72	Excellent
A	135	65	82	Good
A	135	65	97	Poor
A	150	65	56	Good
A	150	65	66	Good
A	150	65	72	Poor
A	150	65	80	Unsatisfactory
A	190	65	41	Excellent
A	190	65	45	Good
A	190	65	47	Unsatisfactory
A	190	65	50	Unsatisfactory
B	135	65	81	Excellent
B	135	65	82	Excellent
B	135	65	94	Good
B	150	65	63	Excellent
B	150	65	68	Excellent
B	150	65	70	Excellent
B	150	65	85	Good
A	150	180	75	Good
A	150	180	105	Unsatisfactory
A	150	180	120	Unsatisfactory
B	150	180	116	Excellent
B	150	180	120	Excellent
B	150	180	123	Good

A = Uncoated.
B = Silicone coated.

2. Lowering the wax pouring temperature improves demolding. At pouring temperatures near the wax melting point, however, foaming causes a rough top cake surface. Pouring temperatures 20-25° F. above the melting point promote good cake demolding characteristics while minimizing foaming.

3. Heating pans to melt residual wax left in the pan significantly raises the temperature at which the wax cake can be demolded.

4. Increases in allowable demolding temperature achieved by coating pans, wax temperature control, and heating pans are approximately additive.

A summary of the laboratory results is shown in Table 1. The effects of coating and pan temperatures on demolding are shown in the graph.

The procedure used in the laboratory studies establishes relative relationships between coatings and conditions. The plant exerts more vigorous action in removal of the cake than that used in the laboratory.

Removal of Wax Cakes

Other equipment changes investigated included items for physical removal of wax cakes. Such items as "knocking bars," although effective in cake removal, were found to produce too severe a mechanical shock to the molder. Pan flexers, spring-loaded rubber wheels mounted so that the pans are bent or flexed when passing over the wheels, were already a part of the equipment. It was found that they contributed to demolding although their performance could not be comparatively evaluated.

Eliminating Moisture

Steps taken to eliminate the moisture problem included:

1. Application of a silicone coating to the molding pans.
2. Installation of electric-resistance heaters to heat pans.
3. Overhaul of tempering exchangers and pan flexers to place them in top operating condition.

These changes were made during a routine maintenance turnaround.

Air Conditioning Cost Too High

Air-conditioning was eliminated as a solution to the problem because of costs. Estimates indicated the cost would be approximately 20 times greater than the changes that were made. Operating expenses would also be high.

Demolding Temperature

Very good agreement was obtained between laboratory predictions and plant performance. Wax cakes were demolded in the plant at temperatures as high as 100° F. but an operational target of 85° F. was selected for normal use. At 85° F. wax cakes demold freely and are sufficiently above atmospheric dew points to prevent moisture condensation. Cake temperatures of approximately 30° to 40° F. had been required before the changes were made. Data from actual plant operation are shown in the graph for comparison with the laboratory results.

Actual performance of the heated silicone-coated pans in the molding machine more than exceeds expectations. Moisture condensation on the cakes has been eliminated, production rates have been increased and wax-cake appearance is greatly improved for added customer appeal.

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The first step in improving most wells is to remove mud from the well bore and the formation. This restores the original formation permeability and improves results from later treatments or production efforts.

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In many cases where natural permeability is good, mud removal is the only treatment needed. In other cases where acidizing or fracturing is necessary, best results are usually obtained from the stimulation treatments if mud is removed first. This means that most wells are worth more as a result of Dowell mud removal treatments.

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Here's Why You Have A Choice of Three Dowell Mud Removal Agents

If you need to dissolve mud filter cake —

MUD ACID may be the agent to use. It contains hydrofluoric acid, and is designed to dissolve clay minerals. It also disperses the remaining material for efficient removal from the well.

If you need to remove a lot of mud —

MUDBAN* is doing big jobs at low cost. A two per cent solution of Mudban in oil makes an efficient, low-cost mud-dispersing and suspending agent. By actual measurement, 1000 gallons of such a solution has removed as much as 15 barrels of mud.

If you need to "break down" tight limestones or dolomites —

BDA* (BREAKDOWN ACID) may be the best agent to use. This hydrochloric acid solution contains several highly efficient surfactants that improve both its penetrating and mud-dispersing qualities. When properly used, BDA will remove water blocks and prevent or break many emulsions. BDA is an excellent material to break down formations because it can be displaced into the formation at minimum pressure. This makes later treatments easier and more effective.

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STOP THE KNOCKS

. . . and save the pump

Best way to rid pumps of fluid knock is to design it out

A new system of instrumentation determines the causes and remedies of valve knocks in oil-field mud pumps. Result of studies of this problem is that fluid knock can now be designed out of the mud system.

BY SAMUEL L. COLLIER
Mission Manufacturing Co.

MOST of the sounds or knocks in an oil-field mud pump are mechanical. They are relatively easy to isolate. But the sound we sometimes call "valve knock" is harder to pin down.

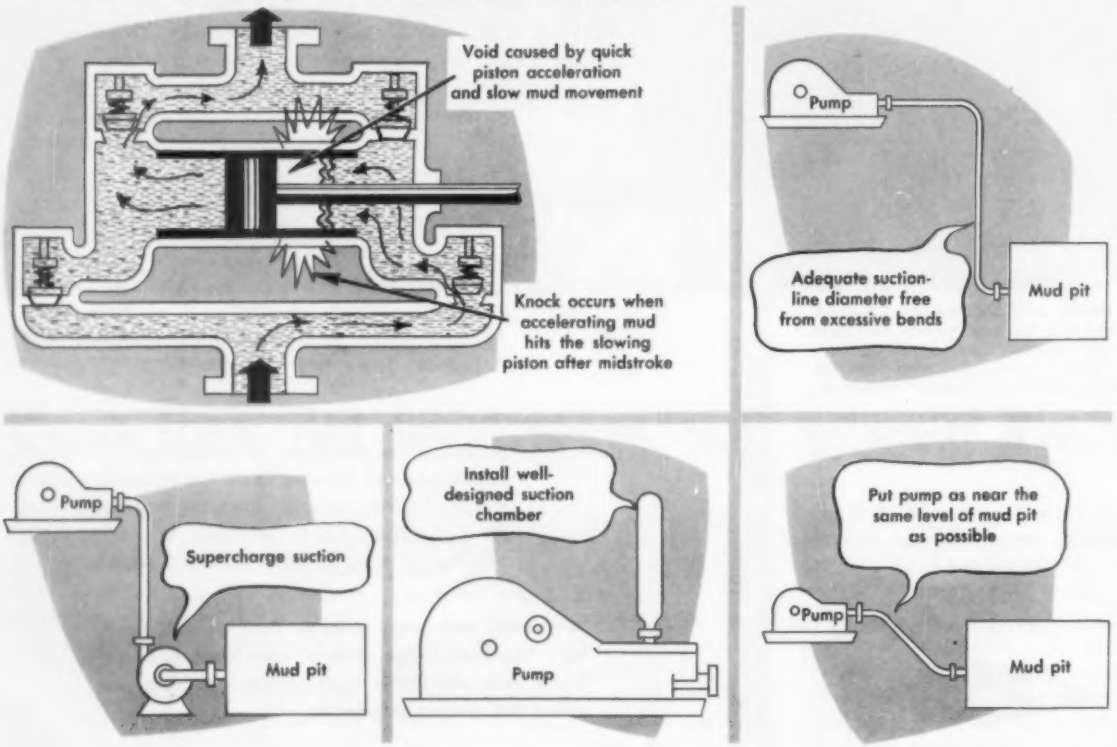
Generally, if we gradually speed up a pump, it will reach a speed at which it begins knocking. The faster the pump runs above this speed the harder the knock is. Or, perhaps a rig pump has run a long time without knocking, then suddenly begins knocking with little apparent cause. Very often, this sudden knocking can be traced to a clogged or collapsed suction line or to a drop in the mud level in the tanks. Or, maybe the temperature or the weight of the mud has gone up.

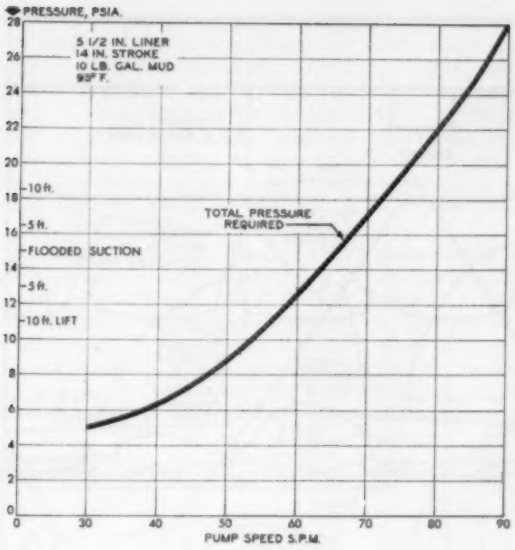
Experiments on a large power pump proved that this is a hydraulic knock. It occurs when the pump operation causes a void to develop in the cylinder. When that void is filled, usually just past midstroke, the liquid strikes the piston. The result is a hydraulic shock wave and a loud knock.

This knock, strangely enough, has no effect on volumetric efficiency of the pump. It does, however, have a big effect on the life of the pump. A mud pump is designed to deliver only a certain number of cycles of work during its useful life. Anything that raises the number of load cycles shortens the pump life. For example, the stress in the piston rod is com-

Author is project engineer with Mission Manufacturing Co., Houston. This article is based on a paper titled, "Fluid Knock in Oil-Field Mud Pumps Due to Separation," presented at petroleum mechanical conference of ASME, Denver.

Why pumps knock—and four ways to stop it


Void caused by quick piston acceleration and slow mud movement
Knock occurs when accelerating mud hits the slowing piston after midstroke
Pump
Adequate suction-line diameter free from excessive bends
Mud pit
Pump
Supercharge suction
Mud pit
Install well-designed suction chamber
Pump
Put pump as near the same level of mud pit as possible
Pump
Mud pit



NPSH chart for a mud pump in one particular set of conditions. It is similar to the NPSH curves used in figuring installations for centrifugal pumps. If this type chart were available for mud pumps, the suction system could be designed so that the pump would never "knock fluid." Fig. 1.

pressive during the forward stroke and tensile during the backstroke. A hydraulic knock tends to reverse these stresses. This puts more load cycles on the mechanism for each stroke of the pump. If the knock is allowed to continue, the result is shorter life for the pump.

Why not NPSH charts? . . . Actually, the hydraulic-knock problem in mud pumps is similar to the suction problems with centrifugal pumps. If the "net positive suction head," or NPSH, on a centrifugal pump is too low at a particular speed, the pump will cavitate and efficiency falls sharply. If NPSH is high enough there will be no cavitation or priming problems and efficiency of the centrifugal will be at its peak.

Manufacturers of centrifugal pumps have for years supplied users with "NPSH curves" on their products. These curves show the minimum net pressure at the suction flange required at various speeds for proper operation of that particular pump. The absolute suction pressure is figured by subtracting from the total absolute head above the pump, the friction loss in the suction line, and the vapor pressure of the liquid being pumped at the temperature of the liquid.

Unfortunately, there is no such information generally available for mud pumps or other reciprocating pumps. As a result, suction systems have been designed and sized by "guesstimation" in the past. But pump speeds are getting faster and the need for concrete information is getting more critical.

Figuring NPSH curves for reciprocating pumps is much more difficult than for centrifugal pumps. But it can be done and Fig. 1 shows a sample curve for one particular brand of pump. This curve is from a test of a 5½-in.-liner, 14-in.-stroke pump, pumping 10 lb. per gal. water-base mud at 90° F.

Notice in Fig. 1 that at speeds higher than about 65 s.p.m., this pump must have a flooded suction or a charged suction. When running at only 55 s.p.m., the pump might lift fluid as much as 10 ft. with no difficulty.

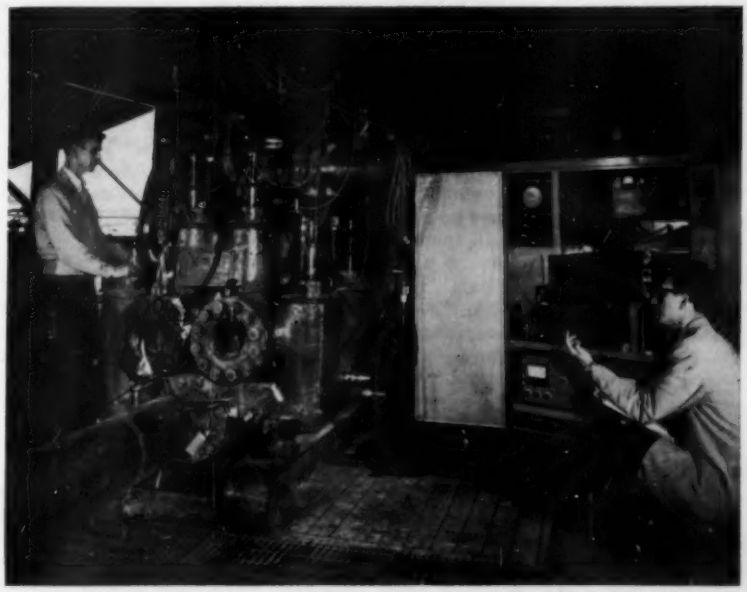
How to use an NPSH chart . . . The time to use an NPSH chart is when rigging up the mud system. At that time you can size the lines and locate the pump in regard to the mud pits. It's much more difficult to correct a fluid knock after the pump has already been tied into a haphazardly constructed mud system.

There are four factors in NPSH; these are head of fluid above the pump, friction loss and inertia demands through the suction lines, and vapor pressure of the liquid. So, we have three ways to get the NPSH we want.

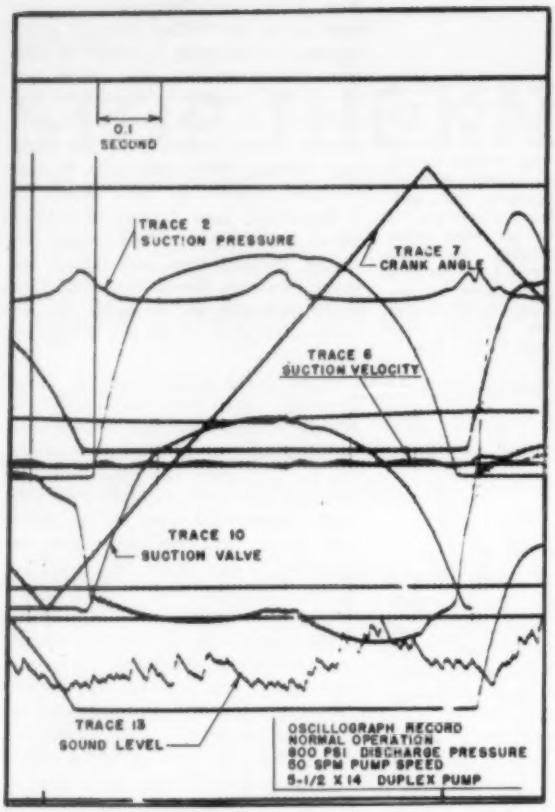
Cooling the mud lowers its vapor pressure, thereby increasing the NPSH. A cool mud does not vaporize readily and a lower vacuum is available to accelerate the mud into the cylinder. However, it's not often that mud temperature can be controlled very close. So we must look for solutions to the other two factors—friction loss and head of fluid above the pump.

Friction loss in the suction depends on the diameter of the lines, length of the lines, and presence of bends, valves, and the like. Common hydraulic tables can show what friction loss will be for each mud-pumping rate.

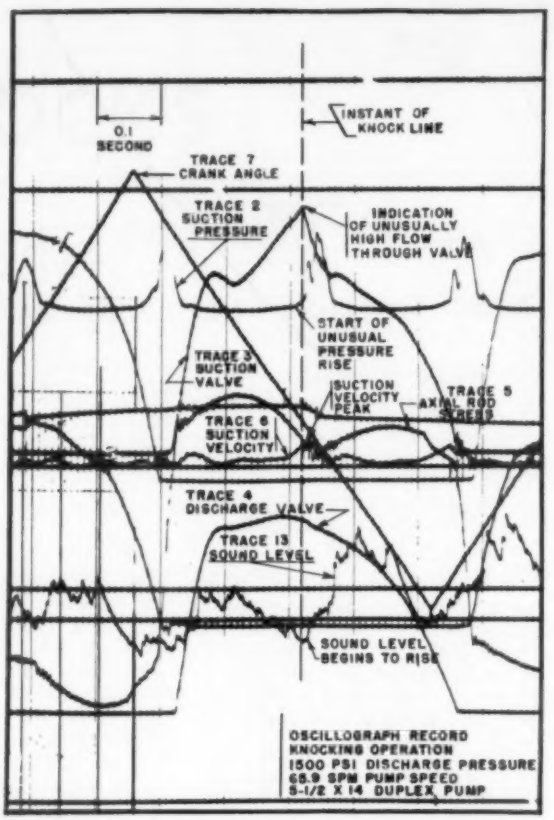
Raising the mud-suction-pit level in relation to the pump suction increases the fluid head on the pump. This helps overcome the friction loss and inertia demands.



TO PERFORM THE STUDIES described in this article, it was necessary to learn the behavior of valves, fluctuation of pump-suction pressures, variation of velocity in the suction, and the speed of propagation of suction-pressure waves. No one had ever studied these things before. As a result, Mission Manufacturing Co. had to devise a new system on instrumentation that would measure pressures and speeds inside the pump while it was running. This is the instrumentation of one pump. Fig. 2.



THIS OSCILLOGRAPH record shows that the pump operation is normal. Note that the sound trace (Trace 13) shows no sharp peaks of sound. Suction pressure (Trace 2) surges follow piston velocity closely and rod stresses are steady. The suction valve (Trace 10) behaves normally except for slight flutter. Fig. 3.



THE PUMP is knocking during this oscillograph record. The sound (Trace 13) has abnormal peaks and suction-pressure has quite high surges. Suction velocity is erratic, indicating that the fluid cannot go fast enough to keep up with the piston. Compare suction-valve action to that in Fig. 3 for normal operation. Fig. 4.

If none of these is successful a supercharging pump may be the only answer. A charging pump is a positive way of increasing suction pressure enough to prevent hydraulic knock.

Suction chambers also may be used. These store and supply small amounts of liquid near the pump as the surge in suction pressure demands. Such suction chambers partially offset the friction loss and inertia demands in the suction lines; they can't be expected to have any effect on vapor pressure or the head of fluid. Still, the knock is usually relieved much sooner with the chamber than without. And the impact is eliminated except occasionally at high speeds.

A suction chamber has difficulty in supplying fluid fast enough at the start of the piston stroke because acceleration is so high. Thus some surging results.

Why the Pump Knocks

Not all sounds in a mud pump are hydraulic knocks. Some of the sounds are detrimental, others are not. Therefore it is essential to make sure just what sounds you are hearing from the pumps. Some of the sounds are "operational knocks." That is, the pump, like any such piece of machinery, has its own peculiar noises even when running perfectly. These do no harm.

Knocks may be either mechanical or fluid in nature. Mechanical knocking normally gives a sharper, more metallic sound than does fluid knocking. Mechanical knocks usually occur over a wide range of pump speeds; usually, they are of a higher pitch.

The noise in the power end is usually mechanical. But it may be transmitted noise from the fluid end. Noise from the fluid end may be localized by careful listening to determine which cylinder or valve pot is the source. Noise which is easy to locate is usually mechanical. If it is hard to locate, it may be fluid knock.

Knocks that develop after maintenance work are often mechanical. The pump should be primed properly and all replacements checked to make sure they are correct. The installation work must also be correct. If the parts are installed incorrectly, there may be striking against the upper valve guide. Other noise can develop from loose liners, pistons, or rods.

If a pump begins to knock after running some time, parts may be broken. Besides, valves may be sticking because of an accumulation of lost-circulation material.

A fluid knock may develop after a long period of operation if the suction line becomes clogged or collapses, if the mud level drops, if mud temperature is high, or if a heavier mud is being used. These are the types of things which can cause poor filling and hydraulic knock.

What causes fluid knock? . . . When the mud-pump piston is at the start of its stroke, it is at a standstill. However, at this instant, its acceleration is great. The mud which should follow the piston as it starts its stroke is held back by its own inertia. If NPSH is high enough it will overcome the inertia and friction of the mud and operation is normal.

But if NPSH is not high enough the mud does not have sufficient energy to equal the acceleration of the piston. The mud literally falls behind. A void forms in the cylinder. Until midstroke, the piston continues to increase in velocity. At midstroke the piston begins to slow down. The fluid, however, continues speeding up because it is pouring into the evacuated space behind the piston. Thus the mud velocity continues to increase at a more rapid rate and it exceeds even the peak velocity of the piston.

The fluid catches up with the piston someplace in the second half of the stroke. At that instant the mud must slow down to the velocity of the piston. The mud is arrested so quickly that there is a high surge of pressure in the cylinder and a water hammer. This blow is the source of the sound we have called "knock"; it occurs at the same instant as the velocity reduction.

Seeing inside the cylinder . . . The preceding description of fluid knock in a pump was not easily discovered. It came as the result of several years' work with a full-size mud pump under laboratory conditions. The study was conducted as a complete analysis of factors governing the life of mud-pump parts.

To find the cause of fluid knocking, the pump was first run with a speed and suction pressure that caused no knocking. An oscillograph record was made of the suction pressure, suction velocity, position of the suction valve, and sound level as they varied with the crank angle. Fig. 3 is the oscillograph record when there was no knocking. The sound trace (Trace 13) shows no sharp peaks of sound.

Then the pump was made to knock. Fig. 4 is the oscillograph record when there was knocking. Notice that the sound trace has large peaks that indicate a sharp sound or knock.

Suction pressure is key . . . One of the most obvious connections with the hammering sound (as shown in Fig. 4) is the suction-pressure trace. In normal operation the suction-pressure surges follow the piston velocity. But when there is hammering the surge is far out of proportion to piston velocity. It is much larger than normal. In the example shown in Fig. 3, the normal suction-pressure surge (Trace 2) has a peak of 23 psi. The abnormal surge (Trace 2, Fig. 4) has a peak of 76 psi.

When variation suction-surge pressure is plotted against suction velocity, as influenced either by pump speed or by liner size, there is no linear relation. For example a 7½-in. liner handles nearly twice the fluid as does a 5½-in. So suction velocity must be twice as high with the 7½-in. liner. If the knock depends on suction velocity, the abnormal surge should occur at much lower speed. However, it actually occurs at only a slightly lower speed.

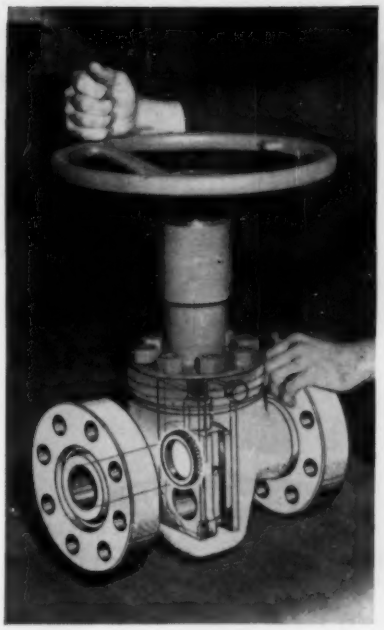
Suction-valve behavior . . . There is another phenomenon that seems quite significant during hammering. This is the behavior of the suction valve. Trace 10, Fig. 3, is a typical curve for the suction-valve motion during normal operation. The curve is regular except for slight flutter and it approximates the rate of flow which varies with piston velocity. Trace 3, Fig. 4, is a typical curve for the suction-valve motion while there is knocking.

Trace 4, Fig. 4, is the discharge-valve motion. The discharge valves are not disturbed during this hammering when suction-valve behavior becomes abnormal. Therefore the knocking should occur in the suction system rather than in the discharge system. This knock sometimes has been called valve hammer, but these tests show that the knocking noise occurs when the valve has ample lift so that the stem does not strike the top guide. In addition, the change in valve motion and great increase in sound intensity (Trace 13) occur in midstroke when the valve is open. It does not occur at the end of the stroke when it is closing and might slam on the seat.

When the investigation got this far the data were somewhat confusing as they make an incomplete story. Besides, volumetric efficiency was high during the hammering. This indicates that cylinder filling was good.

Thus it was necessary to get more information. It was necessary to get a measure of velocity of the surge in suction pressure to determine if it was a water-hammer-type wave or a lower-velocity one. In addition we needed to measure the instantaneous velocity in the suction to determine if the velocity departed from theoretical and, if so, what actually took place.

Velocity of pressure wave . . . In order to measure the velocity of the pressure wave, we installed a group of strain-gage bridges on the suction pipe. The strain gages were used to measure the hoop stress in the pipe. This test proved that the velocity was sonic and somewhat slower in the drilling mud than the 4,000 ft. per second occurring in the water. Theoretical water-hammer equations



ROTATING SEATS REVOLUTIONIZE VALVE DESIGN

In carefully controlled tests Cameron research engineers subjected conventional oilfield valves to continuous operation against high pressure abrasive flow. Wear consistently occurred in the same first-exposed spot on the downstream seat. From these tests has come the new Cameron Type "F" Gate Valve. The central feature of this new design is its rotating seats to spread wear over the entire seating area rather than concentrating it in one spot. Remarkable results achieved with this valve have exceeded every expectation. Here for the first time is a valve with such unusual durability that it can perform any water, oil, gas, or drilling mud service. Its life span is many times that of other valves used for controlling these materials. In pressure controls for drilling and production, you can always COUNT ON CAMERON for the best.

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show that the pressure rise is directly proportional to the sudden reduction in flow velocity.

To measure the normal suction-velocity variation and any sudden change in velocity, we used strain gages in a special way. The velocity pickup consisted of a small drag disk which was supported by a thin rod with a flattened section at the root. Strain gages were attached on both sides of the root section of this cantilever beam and the gage recordings were calibrated.

A traverse was run across the suction pipe to obtain the velocity profile. Thus the average velocity location was obtained and the average velocity could be compared to the velocity from the volumetric test. The velocity probe was then located at the average velocity location.

The results of these tests were very gratifying. In Trace 6, Fig. 4, the velocity begins to rise shortly before the knock occurs. It rises considerably above the velocity proportional to piston velocity. At the instant the knock occurs the velocity drops abruptly to a lower valve.

Based on the sudden change of velocity from that measured by the probe down to that of the piston, the expected rise in suction pressure was calculated. This rise is approximately that expected from the simple water-hammer formula.

This additional evidence made possible the explanation of knock given earlier in this article.

Oscillograph record study . . . The above conclusions were confirmed by running tests simultaneously on both sides of the duplex pump. This insured that some other condition was not the source of the trouble. Further, tests were made when operating only one side of the pump, thus obtaining simplex operation for comparison with duplex operation.

Trace 5 in Fig. 4 is the axial stress in the rod. It always shows a sharp decrease in stress at the instant the knock occurs. This is explained by the unusually high pressure on the suction side of the piston which balances part of the pressure load on the discharge side of the piston. The unusual valve-motion curve (Trace 3, Fig. 4) helps explain this. The valve is a crude flow indicator; its unusual motion curve follows the variations in velocity with a poor response to rapid change. Thus, the rise to the high peak shows the increase in flow taking place in the cylinder. The peak occurs at the instant the valve knocks. Thus the valve merely reflects the flow pattern and has little influence on the flow.

PIPELINES

BY ROBERT E. SCHUHMANN
Supervising Engineer,
Compressor-Station Engineering
Trunkline Gas Co.

COMPRESSOR BUILDING operating floor at Kountze, Tex., showing compressor at right center with portion of gas-turbine prime mover on left. Seal-oil tank is mounted on top of compressor (painted white), along with level controls and supply piping to the unit.

Series-parallel centrifugal compressors bring Trunkline

Improved pumping flexibility

THE DESIGN of the centrifugal compressor on the Trunkline system is the result of the combined efforts of the engineers at Trunkline with the design engineers at De Laval Steam Turbine Co. This design is unique in itself in that it is basically two compressors in one case, each compressor composed of two impellers (a total of four), and all on the same shaft.

This design, of course, enabled Trunkline to use a gas-turbine prime mover then available and still obtain the operating requirements of a gas-transmission system composed of a single cross-country pipeline. Technology and recent past history showed that a gas turbine itself should run for long periods of time without attention or maintenance.

The weak point was that a single centrifugal compressor did not have the operating range to compare with a reciprocating compressor, and a series installation of centrifugal com-

Presented at thirteenth annual ASME Petroleum Mechanical Engineering Conference, Denver.

The author says . . .

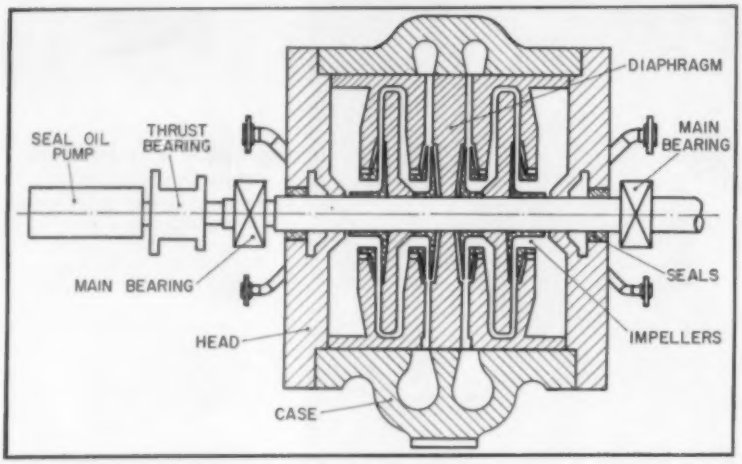
The first of these new centrifugal-compressor units has now operated very satisfactorily on the Trunkline Gas system for over 3 years and proved sufficiently good in its development that two additional units were built in 1955, all of them at different stations.

Since our first modification of the compressor seal-oil and control and equalizing gas-line systems, these units have operated since the summer of 1956 with no down time attributed to the gas compressors. Total operated hours since that time are:

Station 8 at Premont	14,600 hours
Station 23 at Edna	15,000 hours
Station 40 at Kountze	14,200 hours

At this writing there has still been no interruption of these operating hours, with the exception of the equalizing line regulator (seen on Fig. 9) installation at Kountze, although that was scheduled down time. All other down time at these stations has been scheduled maintenance and inspection on the turbine prime movers or other station facilities.

Installed cost to build a station comprising this type of unit is found from experience to be exactly the same as for performing the same function with any other type of compressor and prime-mover combination. Cost to install this single compressor itself is undoubtedly less than two separate units to do the same job. With station operating costs (the sum of fuel, labor, etc.) also the same, then the cost of ownership for this station equipment is obviously the same as for reciprocating equipment.



COMPRESSOR ASSEMBLY drawing shows barrel insert in case, impeller, and shaft assembly. Fig. 1.

pressors could not stay in the design range in operation, would surge, and would require wheel changes to follow changing pipeline conditions, and so forth.

Therefore, to be able to evaluate turbines versus reciprocating engines for pipeline service, it was necessary to achieve the same flexibility in centrifugal gas compressors over the normal range of compression ratios of 1.2 to 1.75. We decided to do this then, and so accomplished an installation which can be directly compared to previous reciprocating stations for performance, initial cost, fuel, labor, down time, and of course total cost of ownership.

Units can now be installed in parallel with each other and a station expanded indefinitely, exactly the same as with reciprocating engines. The location for this first installation in Texas was set at Edna, approximately 240 miles upstream of the next adjacent station on the line with subsequent units at Kountze and Premont, Tex.

It will be the aspect of performance as well as physical construction and description which this article will discuss, rather than detailed calculations of design.

Physical Description

The feasibility of building this unit and achieving the necessary compression ratio using only two wheels of large diameter and high specific speed was first examined, tested, and eliminated before settling on four wheels of slightly smaller diameter. This final design then permitted:

- A low specific speed.
- Small pressure rise per wheel, 82-psi. average at the station design point of 1.57 compression ratio.
- Low Mach number of impeller rim, 0.44 at maximum speed and compression ratio.
- A nearly linear relation for rate of increase of impeller flow area with radius of impeller, cited by some designers as necessarily constant.
- A reasonably large clearance (0.25 in. on the radius) between impeller and diffuser ring, though set by some designers at as much as one-tenth of the diameter. Axial clearance on high-pressure side of impellers is ⅜ in. while clearance on low-pressure side is ⅛ in.
- A vaneless diffuser.

Components of construction of the units are:

1. Case and heads	14,000 lb.
2. Barrel and moving parts	26,000 lb.
Total weight of compressor	40,000 lb.
Weight of soleplate	15,000 lb.
Emergency tank (seal-oil supply)	4,000 lb.
Total weight of unit	59,000 lb.

The "barrel and parts" assembly is comprised of the barrel insert in the case, impeller, and shaft assembly as seen in the simplified assembly drawing, Fig. 1.

Construction of Unit

Soleplate—8 ft., 10 in. wide by 9 ft., 5½ in. parallel to shaft.

Face-to-face distance on flanges 9 ft., 6 in.

Flanges 16 in. ASA 600 octagonal groove ring joint.

Unit set on 2 ft., 3 in. pedestals on the soleplate and shimmed.

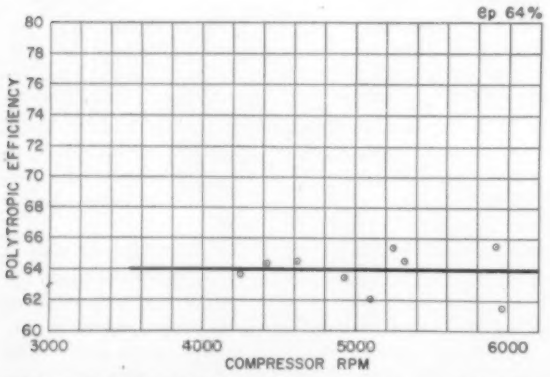
Emergency seal-oil tanks mounted on top of compressor, 8 ft. long by 2 ft. o.d.

Over-all height of unit including tank 11 ft., 3 in. approximately.

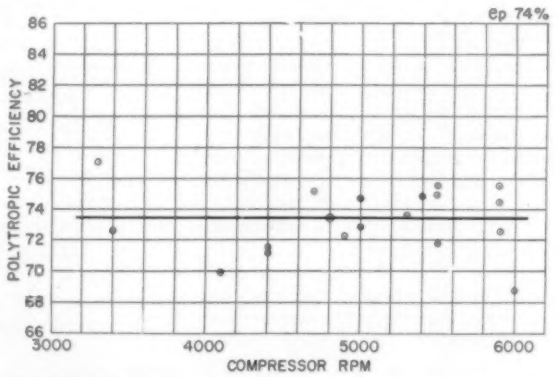
Flanges spaced 32 in. o.c. at 2 ft., 9 in. center line above top of soleplate.

The dual-impeller design first investigated proved to have a rather low polytropic efficiency of some 60 to 65%, as compared with the four-impeller-unit polytropic efficiency of approximately 74%, all other things remaining constant. See Figs. 2 and 3 showing test data.

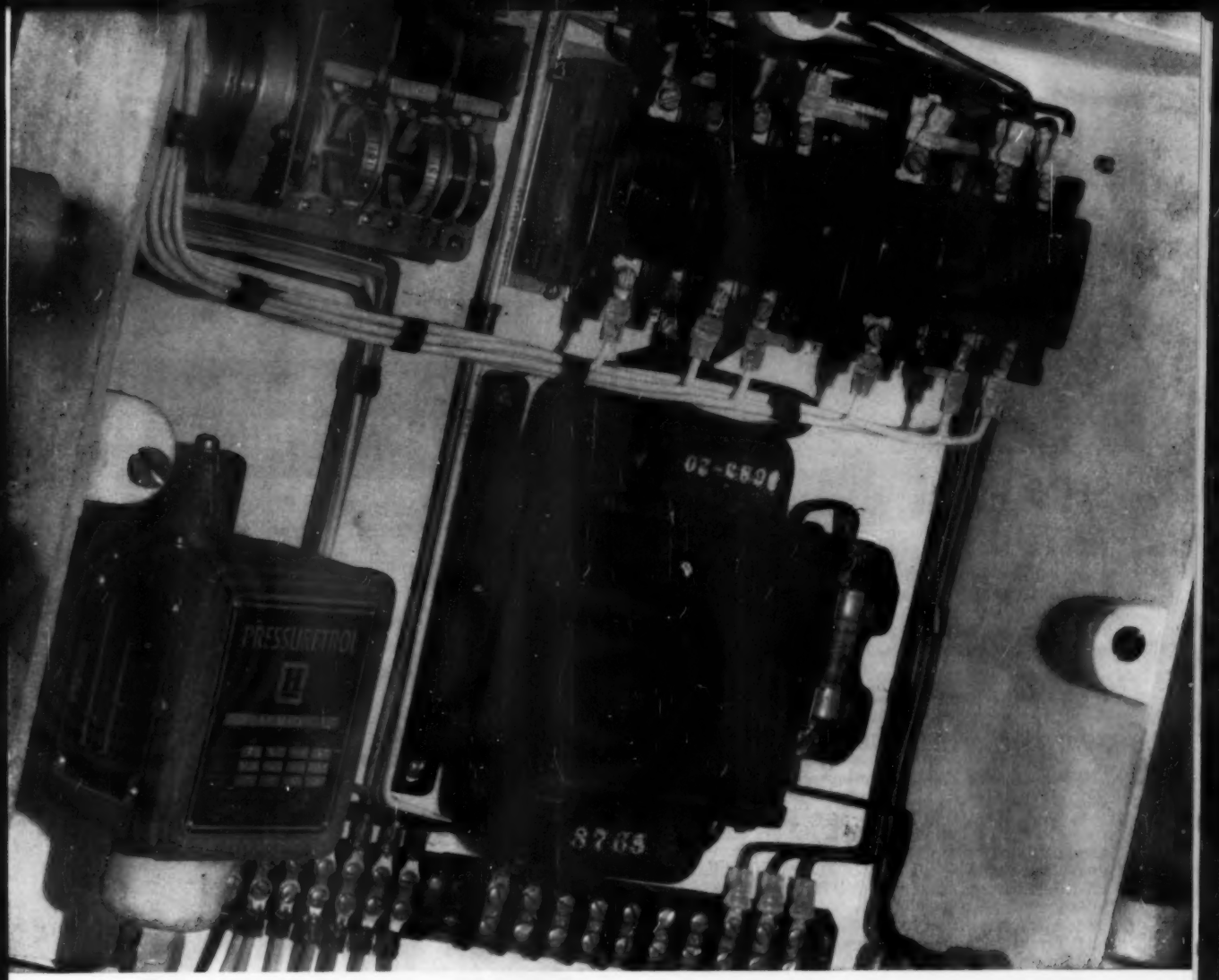
The present polytropic efficiency of near 80% is attributed to a revision,



DUAL IMPELLER DESIGN had polytropic efficiency of 60-65%, in test data taken by Schuhmann and McAnneny at Edna station in May 1955. Fig. 2.



FOUR-IMPELLER DESIGN had polytropic efficiency of 74% in test data taken from June to September 1958 at Kountze. Fig. 3.



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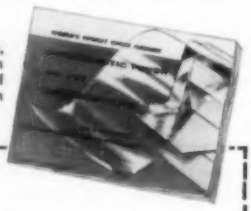

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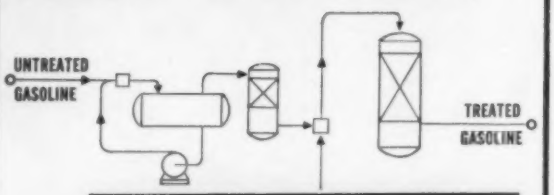

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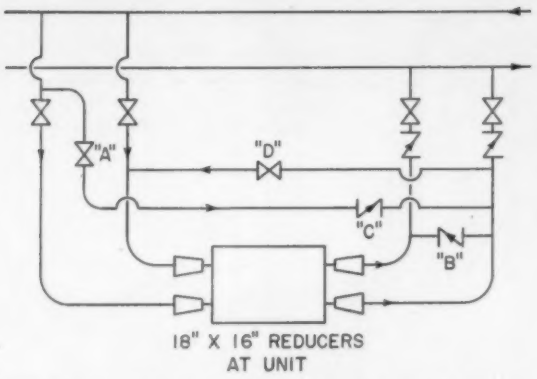
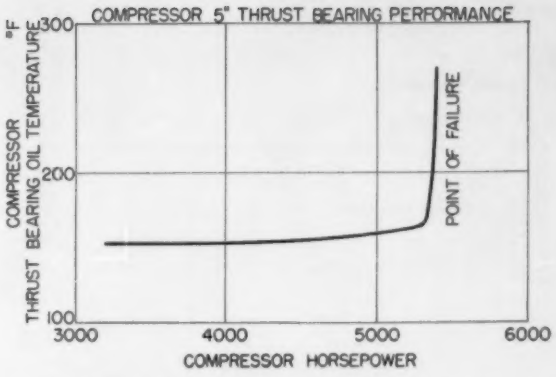


SUCTION AND DISCHARGE piping is simplified by placement of nozzles. Fig. 4.



FIVE-INCH thrust bearing fails from overload. Fig. 5.

after installation, of the sealing system. These efficiency results were determined from the equation:

$$T_2/T_1 = (P_2/P_1)^{(n-1)/n} \quad (1)$$

where

T_2 = compressor discharge temperature, °R.
T_1 = compressor suction temperature, °R.
P_2 = compressor discharge pressure, psia.
P_1 = compressor suction pressure psia.
n = polytropic exponent

and solving for the exponent n; then using the equation

$$e_p = {}^{(k-1)/k} \times {}^{n/(n-1)} \quad (2)$$

where

k = ratio of specific heats
e_p = polytropic efficiency

with all of the pressures and temperatures known from test. The first design using the dual impellers also revealed a higher noise level near the compressor, since this impeller-to-diffuser clearance was small; and so we had approximately a siren effect.

The increase in polytropic efficiency with the sealing system revision was incurred with the elimination of internal gas leakage from the seal on the higher-pressure side to the seal on the lower-pressure side. This will be readily seen with the discussion of the sealing system.

With two suction and two discharge nozzles each, in a single case, the nozzles were placed with both suction nozzles on the same side of the unit, and both discharge nozzles on the opposite side. This simplifies external piping. See Fig. 4. Suction and discharge compressor-loading valves are 18-in. plug valves actuated by piston-driven gear and rack operators.

This is done merely to facilitate remote power operation of the unit from the control room, at the option of operating personnel. A safeguard provided to protect the compressor from destructive surge flow of gas in the reverse direction from normal is the installation of the two 18-in. check valves in the discharge piping.

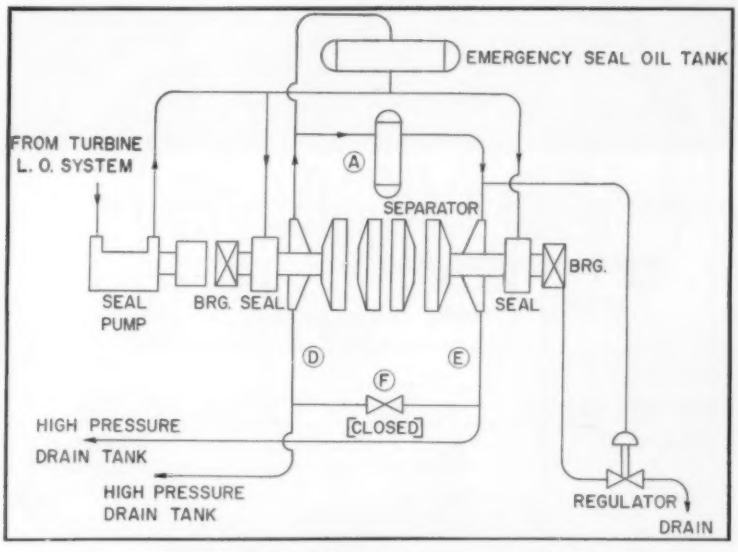
An additional safeguard provided to protect compressor seals and the diaphragm between the two stages is the pressuring valve marked as "A" in the figure. This is used to pressurize the compressor case prior to opening the 18-in. valves, and admits gas simultaneously to the second-stage suction and first-stage discharge, thus minimizing pressure difference across the diaphragm.

Internal flow is such that the gas path is from the outer head toward the middle of the case, with the impellers of the two stages placed back to back. This keeps the lowest pressures on the shaft seals, as well as minimizes the pressured difference across the diaphragm separating the two stages.

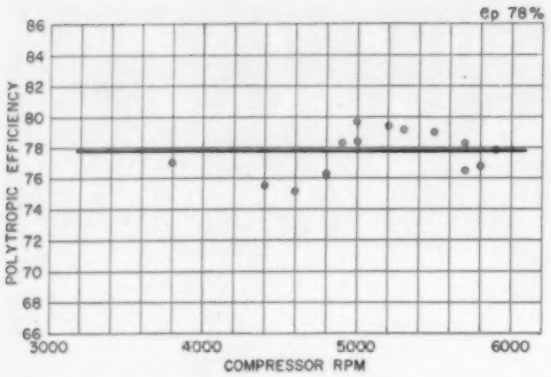
That means the diaphragm does not have to withstand the full pressure difference across the compressor, but approximately only half of it. As well as decreasing the strength requirements of the diaphragm, less leakage is involved through the labyrinth; thus polytropic efficiency is higher.

Impellers are 25 in. o.d. giving a tip speed of 643 ft. per second at 5,900 r.p.m. Diffuser is vaneless type, 25½ in. i.d. and 38 in. o.d. Shaft is, of course, stepped in diameter to avoid critical frequencies. Standard labyrinth is found between all impeller stages. Diaphragm is a nearly flat cast-steel disk, 3⅜ in. thick at the labyrinth near the shaft, widening out and cored near the outer diameter.

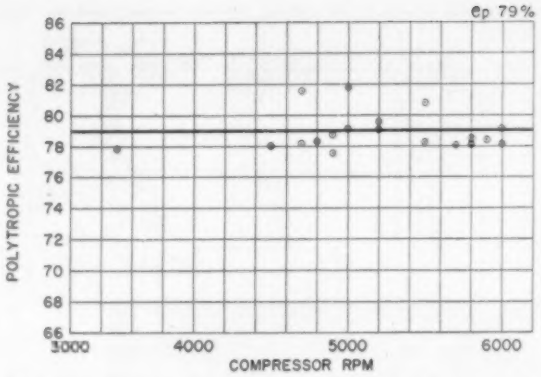
Main bearings are 2¼ in. long by 4¾ in. diameter, babbitted sleeve



OPERATION of seals at two pressure levels. Fig. 6.



TEST DATA at Edna for June-August 1956 show results of seal-drain modification. Fig. 7.



TEST DATA for August and September 1956 show results of modification and installing equalizing line separator. Fig. 8.

bearings. The Kingsbury thrust bearing is set outboard of the main bearing, on the high-pressure side of the compressor case. A 5-in. bearing was first tested; this failed from overload, as seen in Fig. 5. Both 7-in. and 9-in. bearings were also tested with final decision for installation being the 7-in. This has run satisfactorily with only normal wear for 23,000 operating hours.

Since the single case houses all impellers, the unit requires only two shaft seals. This is probably optimum for this size and speed unit, since an overhung impeller would have presented other difficulties. As it is, the main seal-oil pump can be directly shaft driven.

With regard to the seal system, even though the shaft seals on opposite ends of the case are retaining a gas stream at two different pressures, only a single-seal system is used. We are actually doing this in two different ways. One is to draw gas from the higher pressure side to the lower pressure side, such that both seals see a fluid pressure somewhere intermediate between second-stage suction and first-stage suction.

With the compressor operating in parallel, of course, there would be no bleed of gas at all. The other way is to not control the gas retained by the seals and maintain the seals at the same pressure, but rather to control the oil supplying the seals and just let the seals operate at the two pressure levels of second-stage and first-stage suction. These methods used at Trunkline are seen in Figs. 6 and 9.

On the subject of seals an interesting series in design aspects was developed at Trunkline in completing these stations. When the first of Trunkline's three centrifugals was installed in early 1955, the first system tested was the same as the simplified schematic shown in Fig. 6, with the exceptions that the equalizing line separator at "A" was not included, nor was the valve at "F."

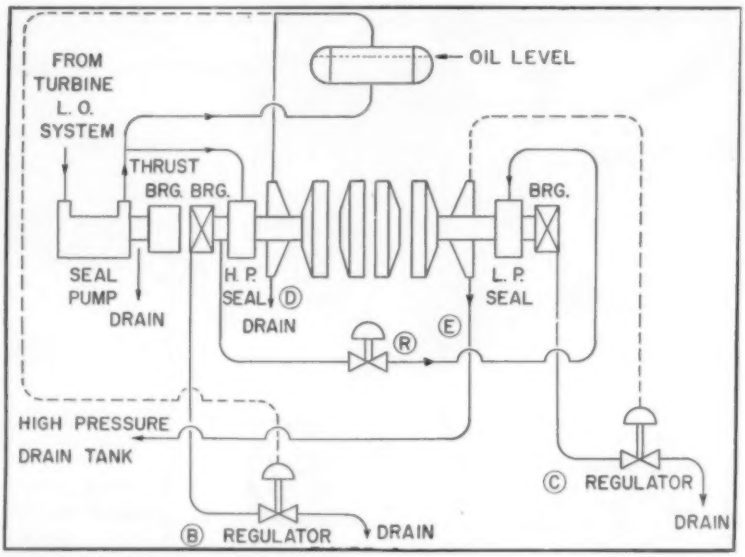
These equalizing line connections from one seal drain chamber to the other have as their single objective to equalize the downstream pressure on the two seals, since both seals had a common oil supply; yet the retained gas pressures varied. The upper line at "A" is 2 in. and initially carried approximately 3 or 4 M.M.s.c.f.d. of gas depending upon operating conditions.

This, of course, resulted in a higher b.hp./M.M.s.c.f.d. (brake horsepower per million standard cubic feet per day) compressed, as well as the initially low polytropic efficiency of the whole unit. Without this equalizing line, however, two entirely separate seal systems would be required, including pumps, controls, and emergency tanks.

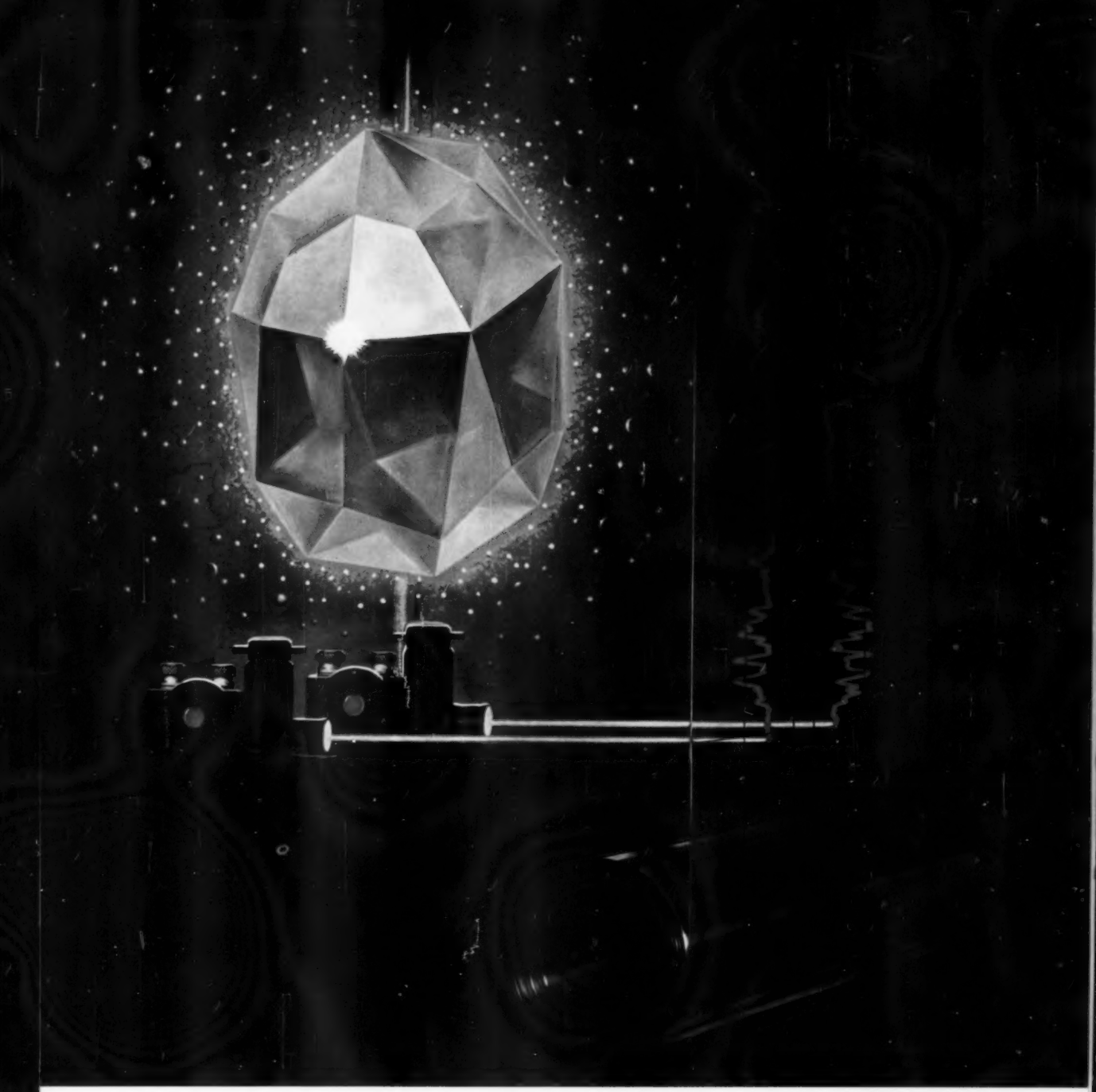
Along with the loss of gas from high stage to low stage, the inherent construction of the machine with this gas flow in the equalizing line was causing a high carry-over of oil from one seal drain chamber to the other, and hence a large loss into the main pipeline stream through the shaft labyrinth into the first-stage suction. Test data on this are seen in Fig. 3, previously mentioned, incorporating four impellers and simplified seal system.

Trunkline engineers and operating personnel then installed the centrifugal separator "A" and valve "F" which recovered from 20 to 80% of oil lost from the seal system. Pressure regulators in both oil-supply and gas lines could have done the same thing. Test data shown in Figs. 7 and 8 show results of installing valve "F" and separator "A," respectively.

It is to be noted here that the spread of points in Figs. 2, 3, 7, and 8



SYSTEM CONTROLS FLOW of seal oil from high to low pressure. Fig. 9.



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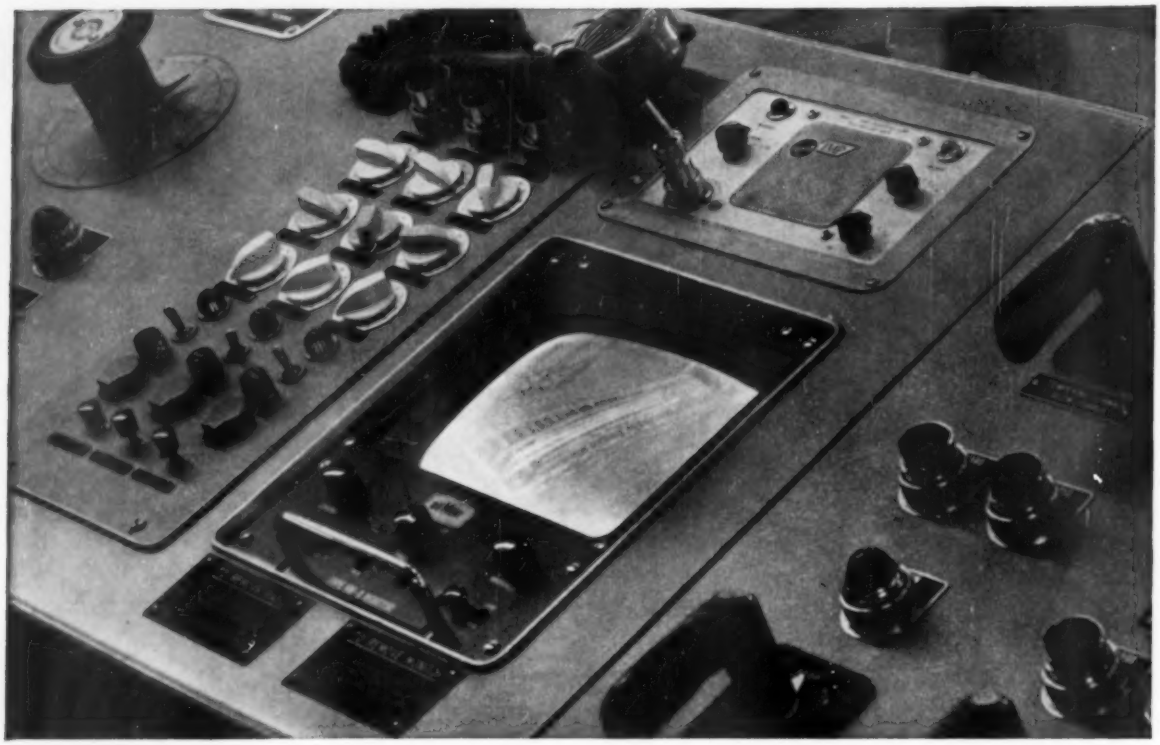

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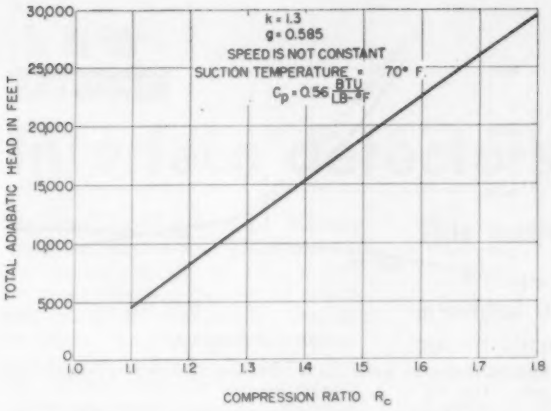
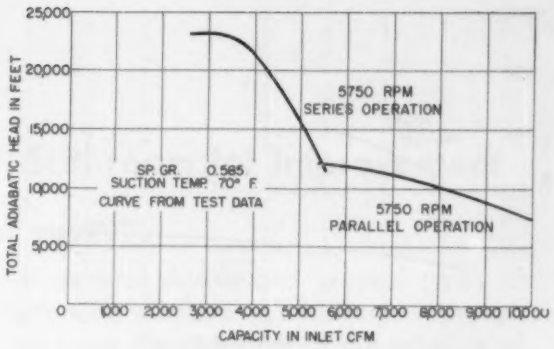


HEAD vs. compression-ratio curve. Fig. 10.



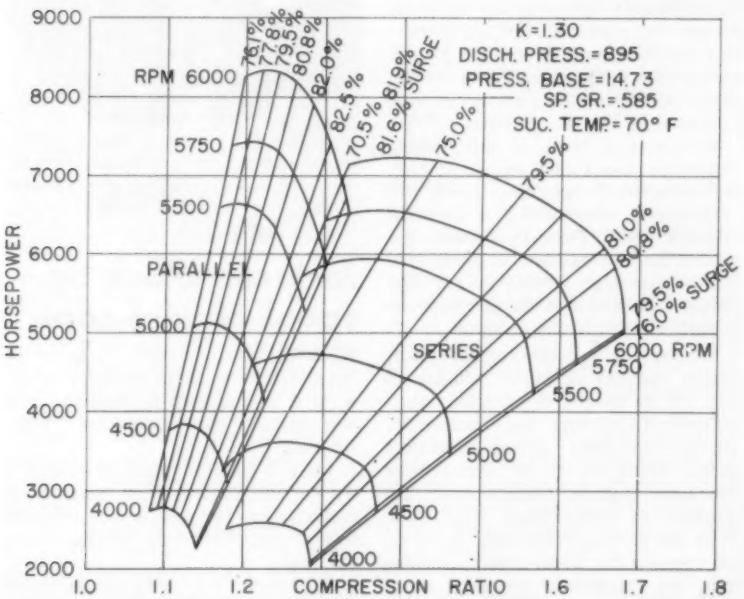
HEAD vs. capacity curve. Fig. 11.

should not be considered too serious since only a 1% error in the determination of the ratio of specific heats or the polytropic exponent "n" can cause a 3¼% error in the calculation for polytropic efficiency. This could possibly be another reason why the adiabatic efficiency is the value usually referred to for comparisons.

Control Seal-Oil Flow

A further modification by Trunkline personnel then served to control seal-oil flow from one seal to the other, thus maintaining the second seal at its correspondingly lower pressure, as opposed to controlling gas flow from one seal to the other and thus maintaining the second seal at the correspondingly higher pressure. This system, Fig. 9, controls oil flow from high to low-pressure side with regulator "R" sensing pressure difference across the high-pressure seal.

The regulator is a fail-safe instrument, providing oil to the l.p. (lower pressure) seal and main bearing. Regulators "B" and "C" in the figure, of course, provide back pressure on the seals and main bearing, the oil being the same for all services. The results of this work yield a total oil consumption on the compressor and turbine prime mover combined oil system of approximately 50,000 b.hp.-hr./gal. of oil. The seals are Kuchler-Huhn spring-loaded carbon rings located outboard of labyrinth glands.



HORSEPOWER-COMPRESSION RATIO PLOT shows series-parallel machine's enlarged plane of operation over single-stage operation. Kountze station No. 40—De Laval compressor design volume 4,500 c.f.m. (series). Fig. 12.

Performance of Unit

Specifications

Normal discharge pressure, psig.	900
Capacity in series, at best efficiency point, M.M.s.c.f.d.	208
Capacity in parallel, at best efficiency point, M.M.s.c.f.d.	600
Normal compression ratio range, at best efficiency point, in series	1.28 to 1.67
Normal compression ratio range, at best efficiency point, in parallel	1.12 to 1.3
Maximum compression ratio range, with inlet guide vanes	1.08 to 1.82
Maximum speed, r.p.m.	5,900

The head vs. compression ratio curve, Fig. 10, is calculated from the usual equation:

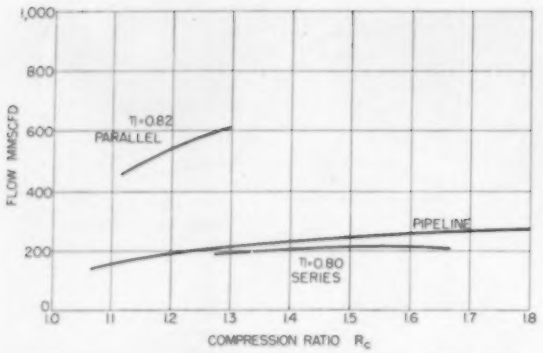
$$H_{ad} = RT_1Z/^{(k-1)/k} \times [(P_2/P_1)^{(k-1)/k} - 1] \quad (3)$$

where

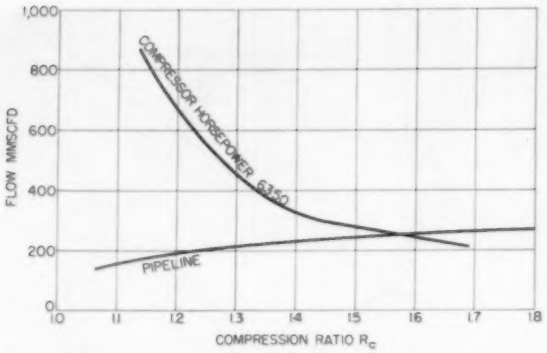
H_{ad} = total adiabatic head
R = gas constant = 89.23
Z = supercompressibility factor
k = ratio of specific heats = 1.3
P_2 = discharge pressure, psia.
P_1 = suction pressure, psia.

compression ratio = ratio of P_2 to P_1, as customarily used in the gas industry. This curve is included for academic interest, since it is not a function of the physical configuration of the compressor although later curves and figures presented here are based on information from this curve, but it is a function of the properties of the gas.

The characteristic which might be



SYSTEM flow vs. ratio. Discharge pressure 895 psia. Compressor curves are at constant compressor efficiency. Fig. 13.



STATION design point curve. Station discharge pressure 895 psia. Fig. 14.

of interest for comparison with other units is the head-capacity curve, Fig. 11. This plot is derived from test data on Trunkline's compressor at Station 23, Edna, Tex. All compressor-unit gas-flow data are obtained with a 24-in. (diameter) meter run in the discharge-gas piping in the station yard.

For all tests in deriving any of these curves, pressure and temperature data are obtained with dead-weight gages and liquid-in-glass thermometers, respectively. With regard to the head-capacity curve, this can be shifted toward the direction of higher head and lower capacity by the use of inlet guide vanes. This is done at Station 8, Premont, Tex., where a higher station discharge pressure at lower flow is necessitated by the pipeline characteristics. Except for that, Trunkline's units are identical.

The adiabatic efficiency by heat balance, using readily measured pressures and temperatures, is, of course, the quantity most conveniently used for performance comparison of a given unit under varying conditions. A very convenient plot of this type of information of interest to pipeline operations is the b.hp. vs. compression-ratio curve shown in Fig. 12. This figure is also shown for operating comparison with reciprocating compressors for which data are usually shown on this coordinate system.

The advantages of the series-parallel machine can be seen on this plot; namely that the plane of operation is greatly enlarged over a single-stage machine. The b.hp./M.M.s.c.f.d. compressed curve for this machine would be a family of curves similar in appearance to Fig. 12, for varying efficiencies.

Actually, to achieve this wide band of operations and to be capable of operating alongside reciprocating compressors, the impeller design must of necessity be something of a compromise, and yet the efficiency at low ratios is seen to be even higher than many reciprocating compressors.

The efficiencies shown on Fig. 12 are seen to be among the highest values of points plotted on Fig. 8, and occurred in the drafting procedure of fairing the curves. The data are considered to be still within the accuracy of test and calculation procedures.

System flow plotted against compression ratio presents the inherent match of a centrifugal compressor to a pipeline, the pipeline flow being plotted with the Panhandle equation. Fig. 13 shows such a plot where constant compressor efficiency conforms very closely to a pipeline curve. As additional pipeline loop is added for a station, the compressor performance is still within the bounds of pipeline flow even though at a different efficiency.

Where this machine has its advantage, of course, is for pipeline capacity to increase to the extent of high-efficiency operation for the compressor in parallel. For simplicity, only two efficiency curves are plotted in this illustration since in reality the major portion of the field is covered, as shown in Fig. 12 previously.

In operation, then, as the pipeline dispatcher varies flow in the system, the compressor operating point will very nearly move down a constant efficiency line. The curves shown are plotted for convenience for a constant station discharge pressure; so if that pressure changes then the curves merely shift relative to the ordinate.

In over-all gas-transmission-system design families of curves similar to Fig. 14 are usually constructed; intersection of pipeline and compressor curves determine design operating point. These curves, of course, have the same general characteristics regardless of compression type used. With the series-parallel unit, however, as opposed to single-wheel centrifugals, the compressor operating range is extended into the lower compression ratios (below 1.3).

This development was made in reciprocating, large-diameter, large-clearance compressors 8 years ago by Burt Mast who is now credited with the fundamental concept on these centrifugal units also. Thus as seen in this figure and perhaps as easily by reference to Fig. 12, this design for centrifugal compressors enables the prime mover to be fully loaded down to very low operating compression ratios.

Jack can block up spool of wire rope

WHERE it is necessary to block up the spool of wire rope in order to unwind it, a jack with a triangular base will make this operation much simpler.

First, a base is made by taking 4 by 4's and bolting them together to make a Tee. The jack is then attached to the base with braces running out to the ends.

To unspool the cable, the jacks are put under a piece of 2-in. pipe running through a hole in the spool and the spool is easily freed.

On the Job

PIPELINING

Interface detectors: Still room for improvement

This author says . . .

Phillips uses several makes and several types of interface detectors for various applications. Although our applications cover the detection of the passage of fluid interfaces in a wide variety of petroleum and chemical installations, these comments will be limited primarily to the applications related to pipelining.

BY C. W. BLACKBURN
Phillips Petroleum Co.

IN ONE pipeline terminal handling crude oil, natural-gas liquids and 12-psi. natural gasoline, we use a system to detect interface passage in which the instrument measures the change in amount of radioactive energy penetrating the product. One good feature of this system is that all the required equipment is mounted externally, on or near the pipeline. This allows easy installation and modifies maintenance.

A small capsule of cesium-137, mounted in a sealed can, is strapped to the pipe. This capsule puts out gamma radiations of relatively low energy (0.662 mev.) and has a half life of about 30 years. This source is designed to provide the desired sensitivity and stability.

On the other side of the pipe, diametrically opposite to the cesium capsule, is a measuring cell which converts the radioactive energy it receives directly into electrical energy. This electrical signal is then converted, amplified and fed as a positioning signal to a recorder pen. Thus, the change in density of the liquid causes more (or less) radioactive energy to be absorbed, and therefore the remaining amount of energy which reaches the measuring cell is the key variable.

An adjustable limit switch on the recorder is used to actuate an alarm, which alerts the operator to perform certain remote valve operations as required. Automatic valve operation, which may be desirable for some jobs, is not a practical thing here due to several operating conditions which change daily.

Dielectric constant . . . In our product terminals where large cavern facilities have been either mined or made in salt formations, we use several makes of detectors to sense the passage of the interface between salt water and propane or other hydrocarbons. In these instruments, the change in dielectric constant of the product as the interface passes produces a change in capacitance (in a probe).

This change in capacitance is then fed into an oscillator circuit, changing the level of oscillation The change in flow of current in a plate circuit of this oscillator energizes a sensitive relay and pilots an alarm relay. In these cases the interface passage causes an alarm to sound and a light to come on.

The operator then has plenty of time to operate valves or control pumps. Since these are more or less emergency warning functions and since they very seldom occur, it was considered uneconomical to use the alarm contacts to perform automatic control functions directly.

Still another series of cases in which we use interface detection is the one in which a suction controller setpointer is changed to a preset position whenever a slug of propane approaches the station. The same type of capacitance probe, sensitive to change of dielectric constant, as described in the previous case, is used. In this case, however, the sensitivity requirement is greater because the spread of dielectric constants of the whole range of products handled by this line varies only slightly (about 1.600 to 2.100, depending on temperature).

Specific gravity . . . Another type of interface detector depends on the specific gravity of the product. The bypass sampling of product which is continually flowing through the instrument is constantly being weighed on a set of mechanical scales, and the motion of the balance arm is linked to a recorder pen.

The simplicity and relatively low costs of this system are favorable, but its accuracy is not good enough to initiate automatic product transfer. Another disadvantage of this system is its inherent inability to discern between products having the same specific gravity.

Desirable features . . . Judging from the experience we have had on several types and makes of interface detectors, the capability which seems to be most lacking is reliability. In one instance the calibration would shift due to tube aging; in another the calibration would change when the cover was put on.

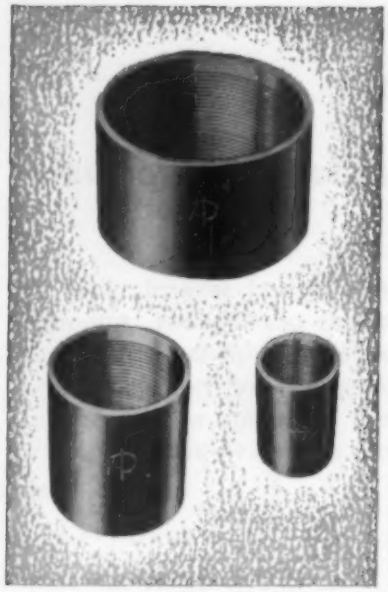
The reliability of some systems is satisfactory, but the price seems excessive considering the relatively simple job to be done. This leads us to outline some of those characteristics which we feel all interface-detection systems should have:

1. Reliability, suitable for unattended operation.
2. Ruggedness, suitable for industrial duty.
3. Means for external adjustment.
4. Means for testing without disturbing the external circuit.
5. Adequate junction space, with a terminal block.
6. Hermetically sealed relays.
7. Disconnecting means.
8. Insensitivity, or compensation for, temperature change.
9. Enclosures and general construction suitable for various classes of locations and ambient conditions.
10. Probe construction adequate for high-pressure systems (in case of probe-type systems).
11. Reasonable price.
12. Means for simple installation and maintenance.
13. Accuracy, repeatability, sensitivity, and stability suited to the application.

All of the interface detection systems we have are deficient in one or more of these points and some are quite seriously deficient.

Since interface detection is such an important function in pipelining we feel that present equipment available to do the job will require a great deal more development work before it will be considered acceptable as a reliable control-system component.

Presented at AIEE Petroleum Industry Electrical Conference, Dallas.



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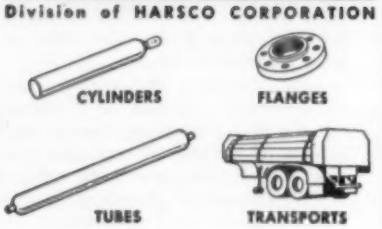

On the Job

PIPELINING

Needed: A good batch interface detector for products pipelines

BY W. W. HOLT, JR.
Technologist, Plantation Pipeline Co.

THE PERFORMANCE requirements of interface detectors on the Plantation products pipeline are most severe.

The system originates at Baton Rouge and extends through the southeastern states and terminates at Greensboro, N. C. Lateral lines serve cities such as Chattanooga and Knoxville, Tenn.; Montgomery, Ala.; Columbus and Macon, Ga.; and Birmingham, Ala.

With such a far-flung system, totaling 2,377 miles of main line and lateral lines, an input capacity of 305,000 bbl. per day, 18 shippers with 60 different products, 3 input points and 18 delivery points, scheduling of throughput becomes a very complicated problem.

Operation of the system requires the use of every reliable mechanical, electrical, and instrumental aid to maintain maximum economic flow rates, accurately measure liquid volumes, and deliver the product to the correct shipper.

At many terminals, if the product is not removed from the pipeline, it would necessitate a return by tank car or truck to the designated terminal. If terminal valves are not properly operated, large volumes can be quickly ruined and will not be marketable.

Manual interface detection . . . With these points in mind, it is quite obvious that Plantation has been anxious to find an instrument that would be accurate and completely dependable in determining batch interfaces. Such an instrument would greatly facilitate the handling of so very many segregated products. Operationally, the interface detection is accomplished manually.

Normally, gravity is measured with hydrometers, but when the gravity of the two products is close, color is used. For color detection, a blue dye is injected and spreads with the interface. This method is also used when two gasolines have the same color. Since these methods are performed by personnel, human errors are involved and mistakes have been made—some have been costly because the pipeline is responsible while the product is in its custody.

Presented at AIEE Petroleum Industry Electrical Conference, Dallas.

Gravitometers . . . During the past 8 years, Plantation has been seeking a batch interface - detection instrument. Continuous - recording gravitometers are installed at all pumping stations and terminals. These have been a great help in tracking interfaces for dispatching purposes, but this has been the extent of their use.

They are not considered sufficiently reliable for use in cutting batches. Although they are pressure compensated, sharp changes in pressure give an indication very similar to a batch change. As specific gravity changes approach ± 0.005, the instrument is unreliable.

Capacitance-type instruments . . . The dielectric property of petroleum has been considered by many in the industry as a reliable indication of a particular batch. Three different capacitance-type instruments have been tested on the Plantation system. Some of these, at first, showed promise, but with extended testing either became insensitive or were unreliable.

It was found that a small deposit of iron rouge, 1-5 μ in size, rendered the capacitance probe insensitive to dielectric changes. Filters proved to be inadequate to overcome this difficulty. It was also impossible to determine when the rouge accumulation would occur and render the indicating instrument inoperative.

Also, during the tests with the capacitance-type detectors, it was discovered that entirely different type products could give identical dielectric indications. The most unusual was one batch of kerosine and a premium gasoline indicated the same conductance. Dissolved water and free water also imposed a possible error with this type instrument. All components of this instrument were reliable except the probe or cell.

Colorimeters . . . Another property, color, has been investigated without any great success. Colorimeters are delicate and the one tested proved unsatisfactory for field work. Blue dye plugs were successfully tracked at six stations located along 450 miles

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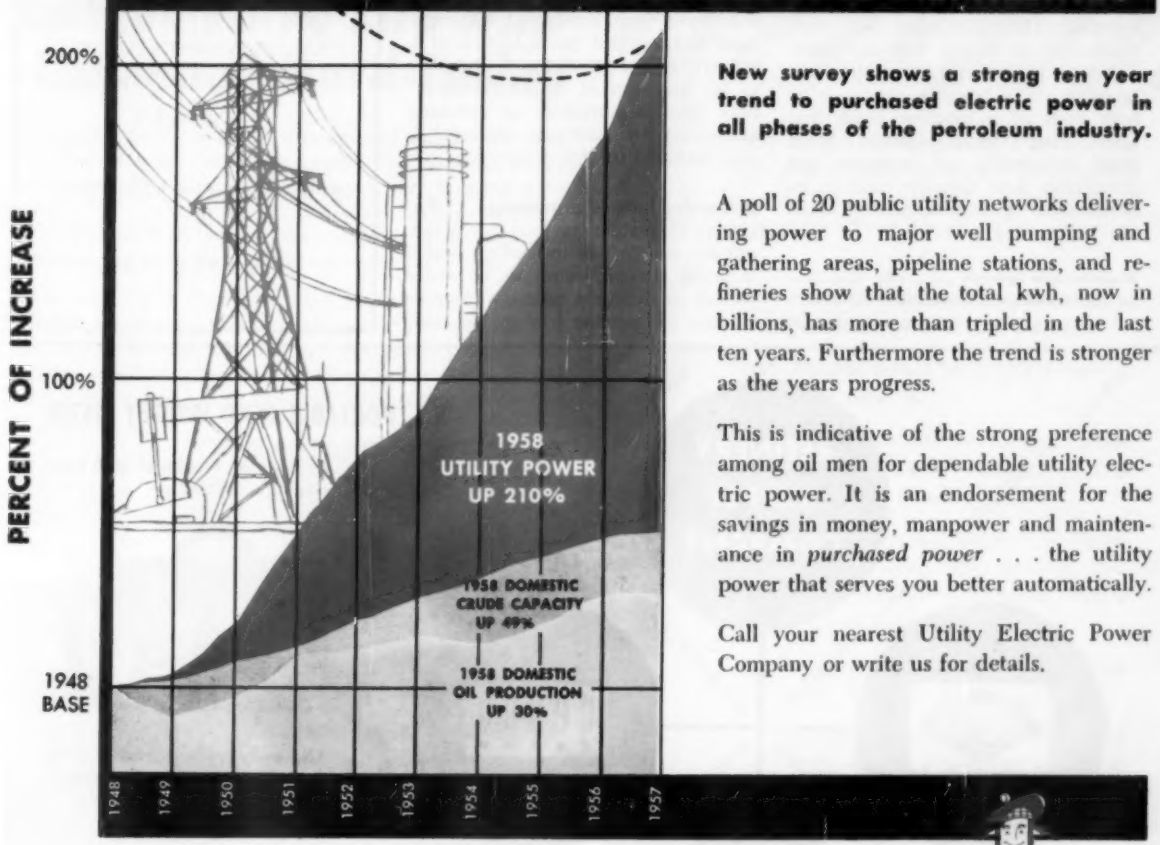
IN WELL PUMPING, PIPELINES AND REFINERIES



New survey shows a strong ten year trend to purchased electric power in all phases of the petroleum industry.

A poll of 20 public utility networks delivering power to major well pumping and gathering areas, pipeline stations, and refineries show that the total kwh, now in billions, has more than tripled in the last ten years. Furthermore the trend is stronger as the years progress.

This is indicative of the strong preference among oil men for dependable utility electric power. It is an endorsement for the savings in money, manpower and maintenance in *purchased power* . . . the utility power that serves you better automatically.

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of 18-in. pipeline. It was established that the color spread very closely matches the gravity spread. The sensing of color differences in batches is not reliable because dirt and water also produce color change indications. Further tests of colorimeters have been abandoned.

Viscosimeter, flash-point indicator . . . Some work has been attempted with the recording viscosimeter. It is possible to detect the difference between gasolines and fuels with this instrument, but distinguishing between gasolines is impossible, because their viscosities all fall within a very narrow band. This property of petroleum is unreliable for batch detection.

Flash-point indicators have been investigated and one such instrument tested. This was of the laboratory type and could not be permanently installed. This instrument was very satisfactory in determining safe kerosine from an interface of gasoline and kerosine. It is possible to use it at both ends of a kerosine batch and safely "cut" good kerosine. Since these instruments are expensive and continuous flash samplers have an inherent time lag, their installation could not be justified.

Radioactive tracers . . . The injection of the subsequent detection of radioactive tracers have been considered by Plantation, but thus far no actual tests have been conducted. Management believes that the detection of a property of the petroleum is preferred to the detection of radioactive materials. The measurement of radiation absorption by different products is also included in this preference.

Refractive indices promising . . . Recently, Plantation has conducted laboratory tests of an instrument which indicates the difference in refractive indices of different products. Sample batches of gasoline having the same gravity were readily distinguishable. Wet kerosine, 2% water by volume, gave the same indication as dry kerosine.

The addition of dye in far greater concentration than possible in the pipeline, did not affect the reading; 0.1% by volume of gasoline in kerosine could be detected. These laboratory results have been most encouraging and Plantation plans to conduct field tests of this instrument in the immediate future.

Plantation desires an instrument that will, without question, detect product interface. No instrument thus far tested has demonstrated the required reliability imposed by this company for its complex operation.

A Journal Special

IT'S BARGAIN time again, and here's one that can't be beat—absolutely free. It's The Oil and Gas Journal's annual index of stories which appeared in the magazine during 1958.

It has become a valuable book over the years for readers as a quick reference to articles printed in the Journal.

Copies of the index are free to Journal subscribers. Just drop a postcard request to The Reader Service Department, The Oil and Gas Journal, Box 1260, Tulsa, Okla. The index will be mailed just as soon as it's printed in early January.

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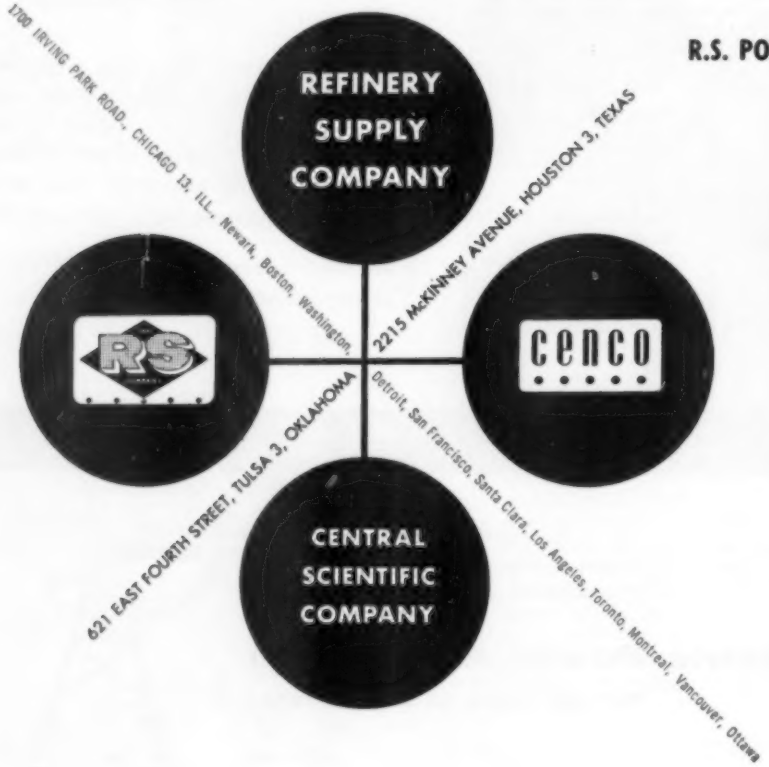
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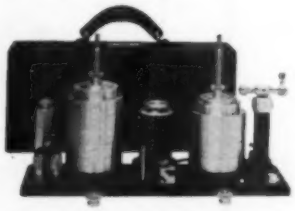


The only truly portable dead weight tester of this capacity

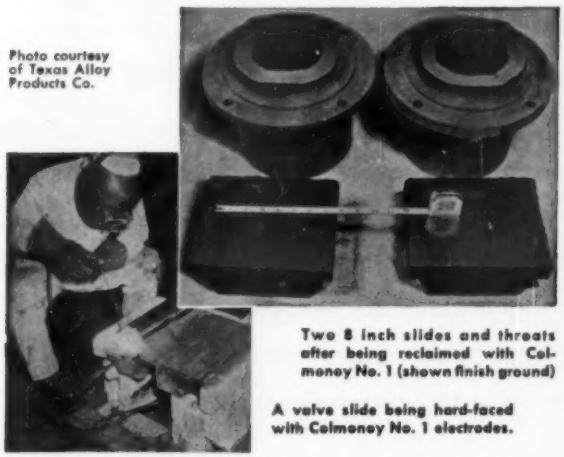
An extremely compact instrument for pressure gage testing and calibration to pressures of 5,000 psi. Standard Accessories include an adaptor so the tester may also be used as a dead weight gage. Can be furnished in ranges of 5-1000 psi or 50-5000 psi.

Longer Valve Life with Colmonoy Hard-Facing

Catalyst slide valve gates, throats, and bodies last up to five times longer when hard-faced with Colmonoy No. 1 electrodes. The success of Colmonoy No. 1 in resisting erosion by catalytic fluids has made it the standard material for hard-facing slide valves by many maintenance shops, job shops, and valve manufacturers.

Colmonoy No. 1 electrodes have a new metallic coating that improves arc stability, permits vertical welding, and eliminates weld cleaning between successive passes. This reduces welding time to cut the already low cost of reclaiming valves with Colmonoy hard-facing.

Photo courtesy of Texas Alloy Products Co.



Two 8 inch slides and throats after being reclaimed with Colmonoy No. 1 (shown finish ground)

A valve slide being hard-faced with Colmonoy No. 1 electrodes.

Write for Colmonoy Hard-Facing Manual #79 for more about Colmonoy hard-facing alloys and methods.

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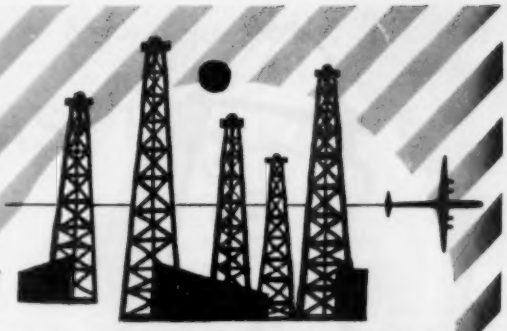

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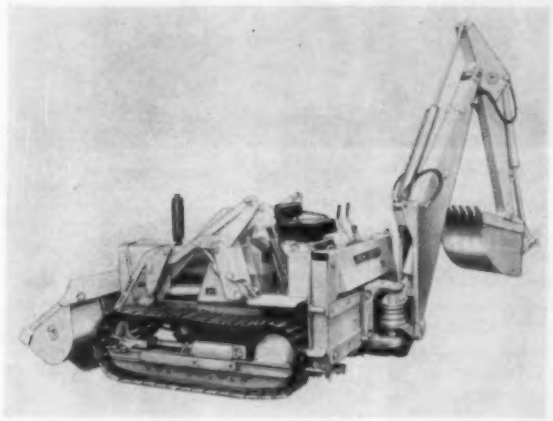
This week's SHOWCASE features . . .



Diesel-powered tractor available

. . . in crawler and wheel models. The Deere Model 440 tractor is now available in both diesel and gasoline-powered units. The diesel-powered tractor delivers about 10% more power than previous models. The engine employs a two-stroke-cycle and has a 3⅞-in. bore and a 4½-in. stroke. It is rated at 33¼ hp. at 1,850 r.p.m. Displacement is 106.1 cu. in., compression ratio is 17:1, and maximum torque is 108 lb.-ft. at 800 r.p.m. **Write or call: John Deere Industrial Div., Deere & Co., 3300 River Drive, Moline, Ill., for details on Model 440 tractor.**

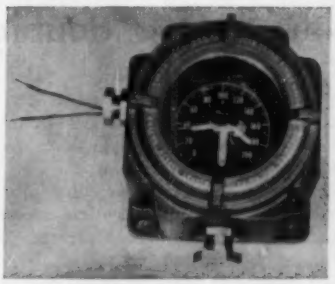
Hydraulic vibration snubber

. . . restrains shock loads. The snubber promises to prove useful in refineries to restrain rapid movements caused by dynamic vibration and shock loads and by the slower natural movement due to thermal expansion or contraction. The rapid vibration movements are restricted by the snubber assembly. The more gradual thermal movement is accommodated by bypassing hydraulic fluid through a restricted orifice in the piston of the snubber cylinder.

The snubber is an outgrowth of ball type of flexible struts with a self-contained hydraulic cylinder integral in the strut.

The Vibrasnub is obtainable in two sizes—2½ in. with a load capacity of 7,000 lb. and 4 in. with a load capacity of 20,000 lb. It can be installed in any position from vertical to horizontal. The joints at either end of the strut can be attached to a pipe, vessel, or flatplate steel structure by butt welding.

The struts are equally rated for tensile or compressive loads. Applications for the struts include use as structural sway bracing for hot stacks and pipes, supports or hangers for horizontal piping, stability supports for tall or slender towers, structures, or vessels, and restraints to direct and control thermal expansion away from weak parts of equipment. **Write or call: Barco Mfg. Co., 500 North Hough Street, Barrington, Ill., for details on Vibrasnubs.**



Explosionproof switch enclosure

. . . is now available made of cast Tenzalloy for all Murphy safety switches. The switches for which the explosionproof enclosure is available include a multitude of variations of switches and automation devices.

They range from simple water-temperature and oil-pressure safety gages to an automatic engine control that will start and stop an engine at a time or radio signal, or at some predetermined condition such as pump-pressure variation, tank level, or temperature. The engine control is now obtainable in an explosionproof enclosure. **Write or call: Frank W. Murphy Mfgr., Inc., P. O. Box 1476, Tulsa, for details on explosionproof enclosure for safety switches.**

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to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

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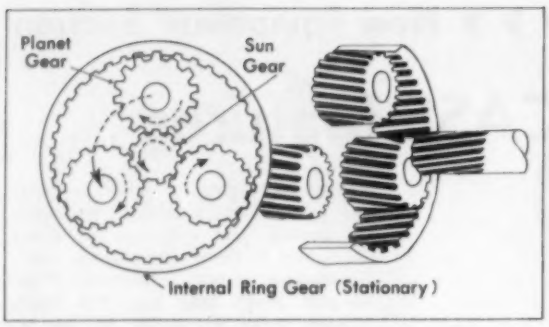


PLANETARY-GEAR system allows use of . . .

. . . smaller-diameter sheave, gives compactness to . . .

New duplex, double-acting mud pump rated at 600 hp.

A 40 to 44-in. sheave is used as compared to a 54 to 72-in. sheave normally required. The Planetary Model HP-16000 mud pump has a bore and stroke of 7¾ by 16 in.

In addition to the planetary gear system, it employs a cylindrical crosshead of plated cast steel operated in a honed cylinder to maintain alignment in every direction and so reduce packing wear.

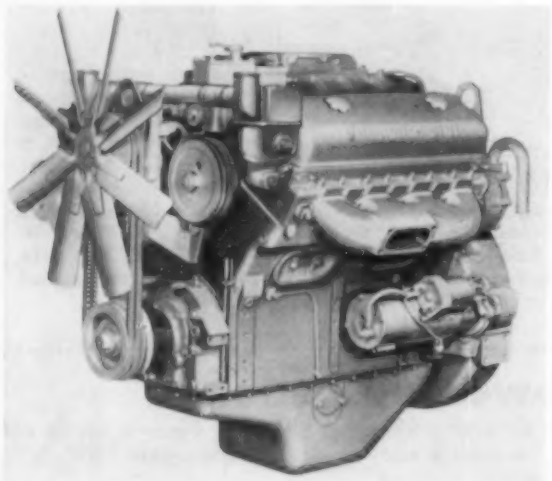
In the planetary gear system, a sun pinion drives three planet pinions inside a fixed internal main gear. The gear cartridge is assembled and inserted as a unit mounted between the 21-in. piston centers. The connecting rods and rod bearings are assembled and mounted to the cranks as a unit.

The sun pinion is integral with the input shaft which floats between the planet gears and the tapered seat in the carrier shaft. Sheave weight and belt pull are transmitted through the carrier-shaft bearings independent of the floating sun shaft. As a result, the sun shaft transmits only the torque load to drive the pump.

The fluid end is a one-piece steel casting. Its features include screw type of stuffing boxes.

Approximate weight of the pump is 31,000 lb. Over-all width is about 6 ft. 10 in., and over-all height from the bottom of the skid to the top of the double-acting pump is about 5 ft. 1 in.

Over-all length of the skid is 16 ft., 7¾ in. **Write or call: Wheland Co., Signal Mountain Road, Chattanooga, Tenn., for details on HP-16000 mud pump.**



V-TYPE and inline models included as . . .

Diesel size range extended

. . . to provide ratings from 20 to 1,650 hp. as compared to 30 to 893 horsepower in the older models. The GM diesels are made in both V-type and inline units in three series—V-71, 6-110, and 53.

All Series V-71 engines have the same cylinder size and general design features. The additions to this series have ratings of 252, 334, 504, and 675 hp. Two of these engines are offered as twin units giving ratings of 1,350 and 1,650 hp.

The Series 53 engines are a new group which includes two, three and four-cylinder inline engines and a six-cylinder V-unit, with ratings of 47, 97, 130, and 195 hp. This series is expected to find use for powering generators, air compressors, core drills, oil-well pumps, workover rigs, and shot-hole drills.

Only three cylinder sizes are used for the group of engines. Pistons, rings, valves, valve-operating mechanisms, injectors and other parts are interchangeable, even between the inline and the V-engines. **Write or call: Detroit Diesel Engine Div., General Motors Corp., 13400 West Outer Drive, Detroit 28, for details on new engines.**

●

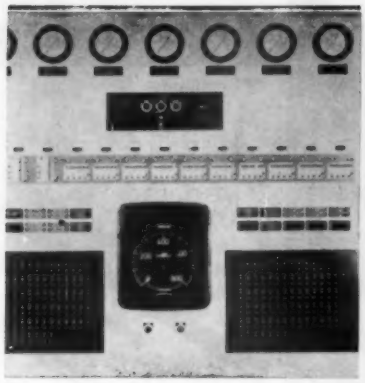
Narrower V-belt design developed

. . . that promises reduced V-belt drive costs. Three cross-sections of the high-capacity V-belt cover the range of drive requirements normally covered by five. The V-belt and its matching sheaves offer a reduction in width of belts and sheaves and a reduction in sheave diameter and center distance for a given requirement.

According to the maker, the Super HC V-belt and companion sheaves can reduce the cost of a drive as much as 20%. The belt has an arched top

to prevent distortion of the tensile section, permitting each tensile cord to carry its part of the load. Improved concave sidewalls eliminate concentrated wear on the sides of the belt and assure precision fit in the sheave groove. **Write or call: Gates Rubber Co., 999 South Broadway, Denver 17, for details on new narrow V-belt.**

●



Automatic alarm scanner

. . . checks five points a second. Automatic scanning of several hundred process measurements is done by the panel-mounted system. This makes it particularly applicable where warnings of critical high or low measurements are essential such as the temperature of compressor cooling water, lube oil, and cylinder heads and levels in tank farms.

As the instrument scans a measuring point, the output voltage of the measuring element is compared with a reference voltage preset on a pinboard to correspond to the high or low temperature at which a warning is desired. If the resulting comparison voltage reflects an alarm condition, it actuates the alarm unit to give visible and audible warning to the operator. Optional is an alarm printer to give the time and point number.

The pulsing circuit sequences the scanner at the rate of 1, 3, or 5 points a second. Each input switch automatically selects the proper thermocouple and connects it to the cold-junction compensation unit. It then selects the corresponding position on the pinboard and pulls in the alarm memory unit for the thermocouple being scanned.

System features include: (1) an automanual switch for manual or automatic scanning, (2) manual switching to an indicator or recorder, (3) variable scan rate, and (4) automatic reset of alarm light when audible alarm is acknowledged and measurement returns to normal. **Write or call: Foxboro Co., Foxboro, Mass., for Data Sheet B.1.1.**

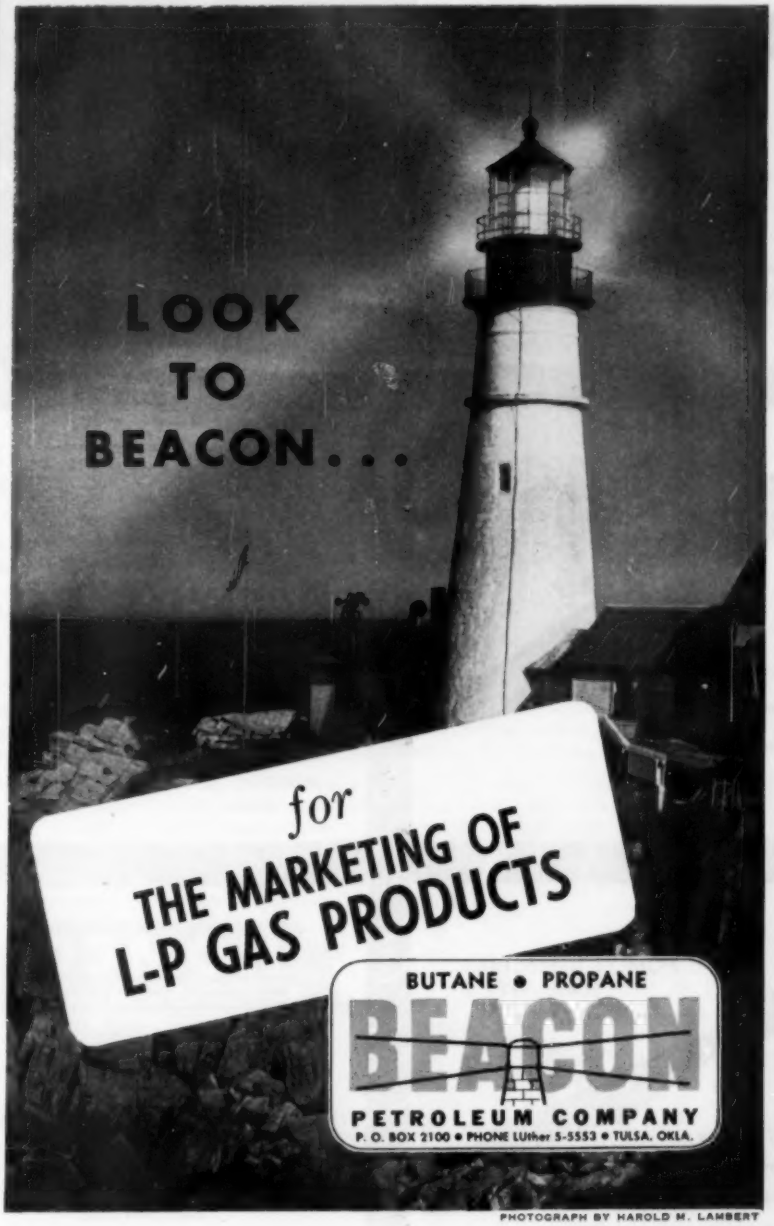
●

Self-propelled mobile generator

. . . is expected to prove valuable in pipeline operations and in refineries and petrochemical plants. It is easily adaptable to provide emergency, standby electric power.

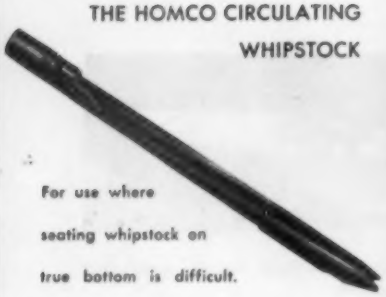
The unit is available in power ranges from 50 to 187.5 kva. It can be obtained with air compressors, water pumps, electric welding machines for field repair, and other accessories.

The unit is highly maneuverable and has an over-all height of only 48 in. For operation in rough terrain, the unit can be equipped with large wheels. The engine is used for both generating power and for propelling



PHOTOGRAPH BY HAROLD M. LAMBERT

THE HOMCO CIRCULATING WHIPSTOCK



For use where seating whipstock on true bottom is difficult.

HOMCO

HOUSTON OIL FIELD MATERIAL COMPANY Inc.

25 Years Experience

KUSTER SINGLE SHOT SURVEY INSTRUMENT

A simple, dependable instrument for quick, accurate records of well direction.

HOMCO TYPE "K" WHIPSTOCK

Where sub-surface conditions warrant the use of a whipstock, the HOMCO Type "K" offers dependable service.

HOMCO'S ANSWER TO YOUR DIRECTIONAL DRILLING PROBLEM

KUSTER "GO-DEVIL" SURVEY INSTRUMENT (DROP TYPE)

- No Lost Rig Time
- Survey your well as you pull your pipe.

HOMCO HOLE OPENER

Furnished with conventional or Klustrite® blades.

HOMCO DIRECTIONAL DRILLING TOOLS

HOMCO Directional Drilling Services are built around tools which have been designed and developed by HOMCO engineers or obtained through purchase of patents from other manufacturers. Continual improvement, through constant research, keeps the tools apace with modern drilling practices. HOMCO offers the industry the most complete selection of directional tools available.

THE HOMCO REPLACEABLE BLADE STABILIZER AND STRING REAMER WITH KLUSTRITE®.

Change blades in matter of minutes.

HOMCO DEFLECTING TOOL—TYPE R

Operating on a knuckle joint principle, obtains a maximum angle of 5 degrees.

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HOUSTON OIL FIELD MATERIAL COMPANY Inc.

HOUSTON, TEXAS

ENGINEERING RESEARCH MANUFACTURING DEVELOPING

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THE OIL INDUSTRY'S MOST COMPLETE SERVICE

HOMCO FULLGAGE DRILLING SPUD BIT

A dependable tool for full gauge deflected holes in soft to medium-hard formations.

the vehicle. Electric output is primarily a.c. with an auxiliary d.c. source. **Write or call: Stewart and Stevenson Services, Inc., P. O. Box 1637, Houston, for details on self-propelled utility unit.**

●

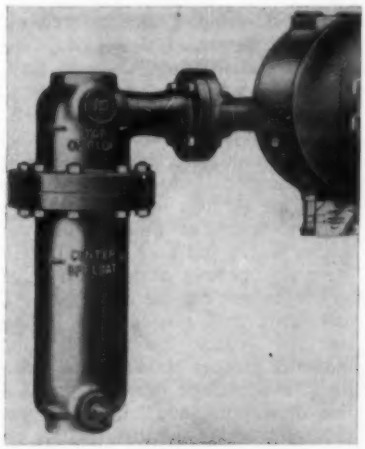
Packaged solvent-extraction plant

. . . for pilot-plant investigations or small-scale production comes in capacities of 20 cc. to 20 gal. a minute. The Podbielniak Spiradyne column-extraction plant is especially applicable for systems where centrifugal force is not necessary for phase separation and where a specific solvent-extraction system does not require extreme versatility.

The plant consists of a gravity type of column with impeller mixing sections for intimate contacting of two phases. The sections are assembled on a rotating shaft controlled by a variable-speed drive. The clarification sections are packed with coalescing materials for phase disengagement.

The assembly offers many flexible features for handling a variety of solvent extraction systems. Enough mixing and clarifying sections can be combined in a single unit to provide a range of up to 10 or more identifiable stages as needed. **Write or call: Podbielniak, Inc., Dept. S, 341 East Ohio Street, Chicago 11, for details on Spiradyne column extraction plant.**

●



Electronic level control

. . . gives proportional signal. The signal is a 1 to 5-ma. d.c. signal delivered through a 3,000-ohm load. Normal 117-volt a.c. power is used as the supply. Use of an explosionproof design and external adjustment for proportional band and liquid-level height make the Type 2300 Level-Trol suited for hazardous locations.

The case is constructed of aluminum and the screw-on cover of cast iron. Two heavy lugs on the cover plate make it easy to remove and assemble. a labeled terminal strip is located in the upper part of the case directly beneath the conduit openings. Two openings are provided. One is for the a.c. power supply. The other is for the d.c. output.

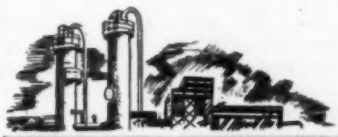
A plug-in electronic converter with a printed circuit is employed to eliminate unnecessary wiring and leads. Only two lead wires are used inside the case. They connect the terminal strip to the fixed and movable capacitor plates.

Capacitor plates are the sensing element of the control loop. They are electrically connected to an electronic converter. The electronic converter sends out to the final control element —control valve—a d.c. signal proportional to the liquid level to position the control valve for the new level conditions. **Write or call: Fisher Governor Co., Marshalltown, Iowa, for Bulletin F-85.**

Smithco pioneered the development of this rugged cooler for severe application. Its functional design, with *excess* cooling capacity, has met and overcome *every challenge* of extreme weather and operating conditions.

The "D" series cooler, latest in the growing tradition of fine Smithco Air Coolers, combines years of qualified engineering experience with the newest manufacturing methods to give you the most dependable unit in it's field.

Their reputation for dependability has attained for Smithco coolers industry wide usage and universal recognition.



Plant & Offices — Tulsa, Oklahoma
P. O. Box 3217

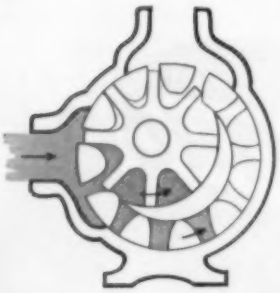
Representatives in the Petroleum Industry

SMITHCO Engineering Inc.

WHY

are Viking rotary pumps

BETTER?



BECAUSE

they are Mechanically Superior

The Viking "gear-within-a-gear" pumping principle makes liquids flow into and through the pump, changing direction ever so slightly until liquids are trapped. This action cuts turbulence, foaming, cavitation and power consumption to a minimum. As a result, liquids are delivered in a smooth, positive flow . . . free of aeration.

TESTED

In test after test the superiority of Viking's pumping principle has been proved over other rotary pump action . . . and even more pronounced when handling fluids of 750 SSU and thicker. Learn the complete story on Viking rotary pumps. Send for free catalog 59ST.

VIKING Pump Company

CEDAR FALLS, IOWA, U.S.A.

In Canada it's "ROTO-KING" pumps
Offices and Distributors in Principal Cities
See Your Classified Telephone Directory

SHOWCASE . . .

New Literature

Motor, equipment failures predicted

. . . by periodic insulation - resistance tests, as described in a new two-page bulletin. A chart is drawn that indicates resistance changes and thus the breakdown of motors and other electrical equipment is forecast. The chart comes from periodic insulation-resistance tests, made with an improved direct-reading megohmmeter that requires no compensations, cranking, or leveling. The procedure is applicable to generators, capacitors, switchgear, and transmission equipment. **Write or call: Associated Research, Inc., 3777 West Belmont Avenue, Chicago 18, for Bulletin 2-60.1.**

Heating units for stress relieving

. . . of large, welded vessels are described in a four-page bulletin now available. The units use the Smith-Dolan system of low-frequency induction heating. The bulletin lists advantages of the system, explains various applications which are said to be cost saving, and includes pictures and specifications of different models. **Write or call: Electric Arc, Inc., 152 Jelliff Avenue, Newark 8, N. J., for Smith-Dolan System of Low-Frequency Induction Heating bulletin.**

Economics of gas-turbine drivers

. . . in refining is the topic of new 12-page Bulletin 166. Particular emphasis is given to turbine design, operating characteristics, and profitable use of a turbine's double function as a source of power and heat. The bulletin details refinery applications involving pump and compressor drives, power generation, and emergency use. It includes performance charts on fuel consumption, exhaust-gas flow, and heat recovery. **Write or call: Clark Bros. Co., P.O. Box 560, Olean, N.Y., for Bulletin 166.**

Snap-on pipe insulation

. . . made of fine-diameter blown-glass fibers is illustrated in a new 10-page folder. The folder shows the insulation's construction, applications, and specifications. Two pages are devoted to sizes and packaging. The folder includes pictures, cutaway drawings, and charts. **Write or call: Gustin-Bacon Mfg. Co., 201 West 10th Street, Kansas City, Mo., for Snap-On Pipe Insulation folder.**

Practical pneumatic-conveyor

. . . design is discussed in new eight-page Bulletin I-28. It gives background information on how to select, operate, and maintain pneumatic systems for transporting dry-bulk materials. The bulletin covers positive, negative, and combination systems, and includes illustrations, graphs, and other technical data. **Write or call: Sprout, Waldron & Co., Inc., 130 Logan Street, Muncy, Pa., for Bulletin I-28.**

Insulating, refractory material

. . . called Foamsil is detailed in new four-page Bulletin FS-1. The new foamed-silica material is 99% pure-fused silica and has a practical operating range of −450° to 2,200° F. Foamsil is not affected by most commonly used acids or by thermal shock, according to the bulletin. It lists physical characteristics of the material, recommendations for possible uses, and available sizes and shapes. **Write or call: Pittsburgh Corning Corp., 1 Gateway Center, Pittsburgh 22, for Bulletin FS-1.**

Two-way communications

. . . parts catalog (1959) is now available. It has been enlarged from previous editions and covers two-way communications parts, kits, chassis, test equipment, and accessories. The catalog features new and improved test equipment, printed-circuit repair kits, and information and components needed for split-channel conversion. The catalog is illustrated with photos, drawings, and diagrams. **Write or call: Parts Dept., Motorola Communications & Electronics, Inc., 4910 West Flournoy Street, Chicago 44, for Communications Buyer's Guide 1-59.**

Glassed-steel reactors

. . . and recent major improvements in glassed-steel composition and reactor design are detailed in new eight-page Bulletin 960. The bulletin also describes drives and accessories, including a new bottom outlet flush valve which features one-piece glassed head and stem, and glassed-filled Teflon seat to reduce maintenance and minimize product build-up. The bulletin gives schematic drawings, installation dimensions, and complete material and working specifications for reactors with capacities ranging from 200 to 4,000 gal. **Write or call: Pfaudler Co., Advertising Dept., 1079 West Avenue, Rochester 3, N.Y., for Bulletin 960.**

Single-stage centrifugal pumps

. . . with open impellers are outlined in new eight-page Bulletin 720.4. The pumps are available in 13 sizes, 1¼ to 8 in. Capacities range to 3,000 g.p.m. and heads to 180 ft. The bulletin contains specifications, sectional views, dimensional charts, materials of construction, parts-interchangeability charts, and performance curves. **Write or call: Goulds Pumps, Inc., 50 Black Brook Road, Seneca Falls, N. Y., for Bulletin 720.4.**

Metallic-organic compounds

. . . are catagorized in a new 36-page brochure. It lists the compounds by main-constituent elements (aluminum, antimony, boron, etc.) and provides convenient reference data on their physical constants, standard packaging, and prices. The brochure contains a section which is devoted to chemicals manufactured in commercial quantities. Specifications and principal uses are listed. **Write or call: Anderson Chemical Co., division of Stauffer Chemical Co., Weston, Mich., for Organo-Metallics brochure.**

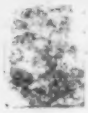
Simplified wall chart

. . . for compression-packing recommendations, suitable for hanging on a wall is now available. The 9 by 17¾-in. yellow and black chart highlights the proper application of rod and sheet-type compression packings. It pinpoints the packing for basic types of service including air and inert gases, water and neutral fluids, acids, and alkalies. The chart was designed to impart new accuracy to the choice of a packing which, by construction, material, and impregnation, is best suited for certain service requirements. **Write or call: E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, for Val-Pac Recommendation Chart.**

PVC pipe and fittings

. . . are outlined in a new brochure designed to answer questions most likely to arise when working with polyvinyl-chloride. The 12-page brochure gives advantages and properties, general characteristics and uses, physical properties, installation instructions, flow-rate charts, and complete specifications for schedules 40 and 80 pipe and the entire line of PVC fittings. The brochure includes a chemical-resistance chart which lists about 350 reagents and their effect upon PVC pipe and fittings. **Write or call: Mueller Brass Co., Port Huron, Mich., for PVC Pipe and Fittings brochure.**

IMPORTANT ANNOUNCEMENT TO OIL SHOW EXHIBITORS . . .



*** On-Site Fabrication and Erection Facilities**

GRS&W nationally prominent designers and builders of Trade Show Exhibits, have opened a branch plant in Tulsa, Oklahoma for the convenience and economy of customers participating in the 1959 International Petroleum Exposition. Plant is only 3 miles from Fairgrounds.

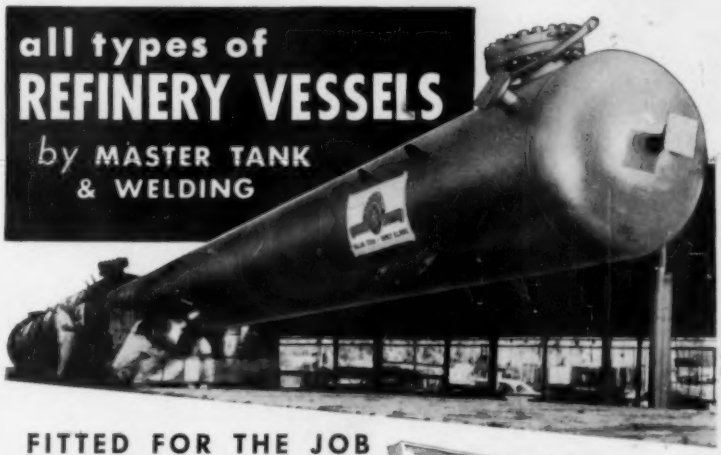
YOU SAVE: PACKING CASE COSTS
TRANSPORTATION COSTS

FOR COMPLETE INFORMATION:
Write to GRS&W, 5875 Centre Avenue, Pittsburgh 6, Pennsylvania (Tel. EM. 2-1400) or GRS&W Tulsa Division, 31st & Harvard Streets, Tulsa, Oklahoma (Tel. Riverside 7-1990)

GRS&W *exhibits and displays*

GARDNER, ROBINSON, STERNHEIM & WEIS, INC. • 5875 Centre Avenue, Pittsburgh 6, Pennsylvania

all types of
REFINERY VESSELS
by MASTER TANK & WELDING



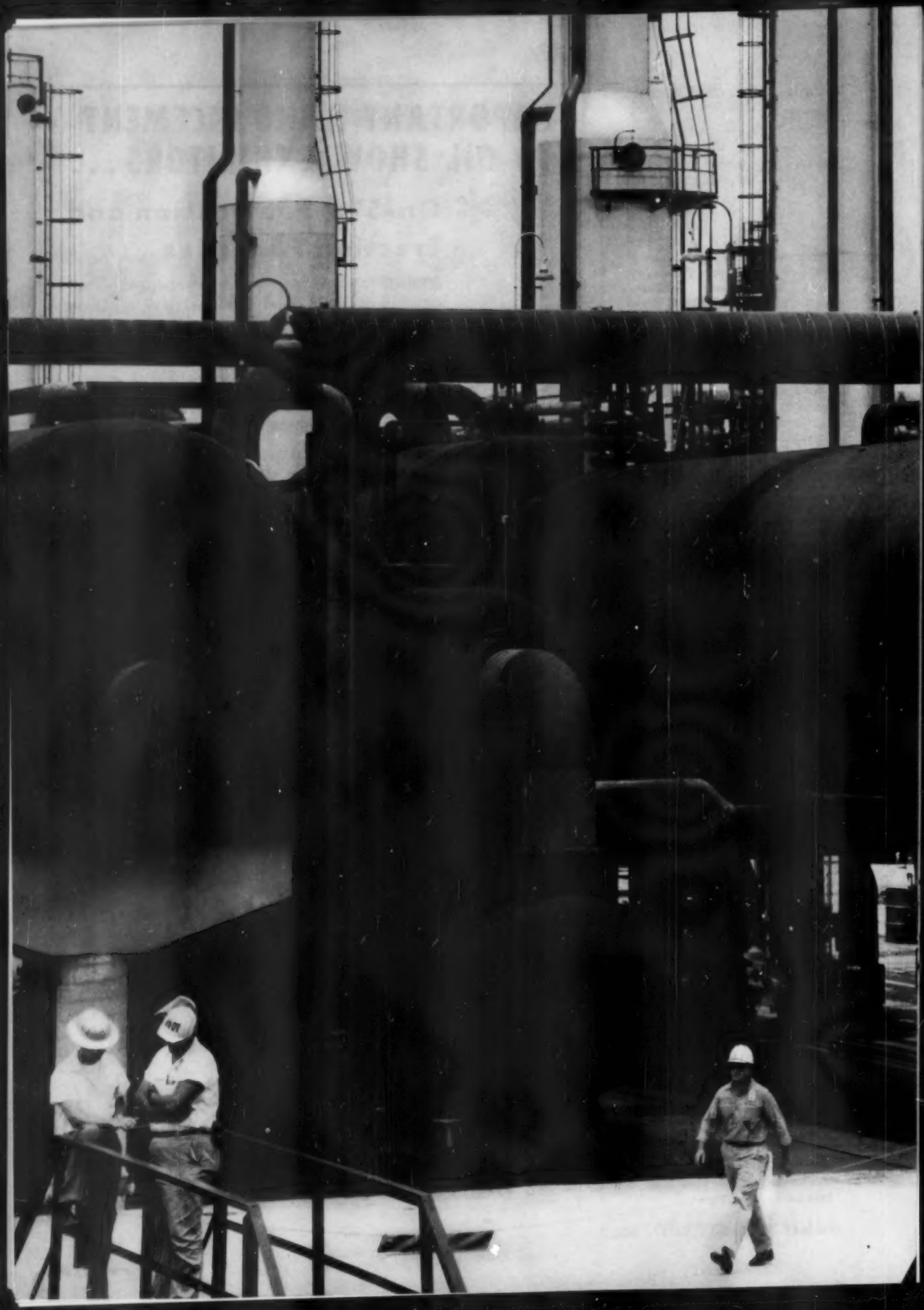
FITTED FOR THE JOB

Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER FIRST for the finest in steel fabrication.

Master also produces
API 5LX HI-TEST
Expanded Line Pipe
20" through 30" or larger

MASTER TANK & WELDING

P. O. BOX 5146 • DALLAS, TEXAS • Riverside 7-2441



These Stratco Effluent Refrigeration reactors are part of the alkylation section of Texas Butadiene & Chemical Corporation's plant in Channelview, Texas. The unit obtains its butylene feed from the dehydrogenation of butane into butadiene and butylene. Depending on marketing requirements, the butylene may be used to make alkylate or recyled back into butadiene production. Alkylation capacity is 6,500 b.p.s.d.

ALKYLATION

There are no easy answers

Automobile engines will continue to demand higher performance from gasolines. Octane numbers will rise and sensitivity ratings will decrease. More gasoline will be produced, and more of it will be of premium grade. The refiners' answer to this challenge will be alkylate—lots of it.

Adding alkylation capacity involves some complex decisions, the weighing of a multitude of factors. Which process to invest in under a given set of conditions; what level of quality to aim for; how large a plant to build—these are difficult questions. To answer them requires a thorough understanding of all the processes, their economics and their practicability under various circumstances.

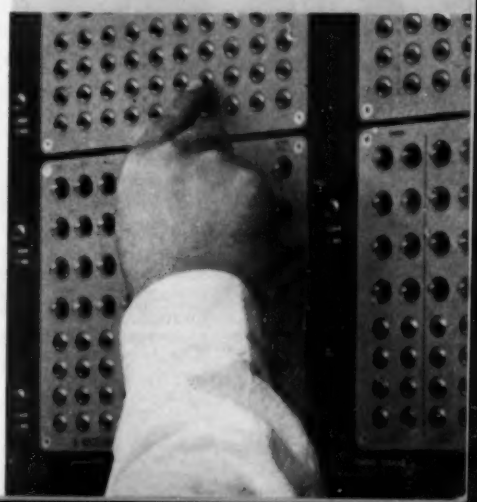
Nearly one-fourth of all the alkylation plants existing today were designed and built by Fluor. This fund of practical experience encompasses all processes under a great variety of circumstances. Fluor's broad knowledge of alkylation should be most helpful to you in planning a plant to fit your set of conditions.

The Fluor brochure, "Alkylation Plants," is a brief guide to the various processes. Write to Dept. 14, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.

When you consider expansion... the most important investment you can make is in the creative ability of men.

FLUOR

Engineers and Constructors



Construction completed on new J&L store-office building

. . . In Shreveport, La. Rainey Elliott, J&L president, said the new quarters were made necessary by the continued growth of the oil industry in the Ark-La-Tex area. The building houses Jones & Laughlin Supply Division's North Louisiana-Arkansas district sales office and the Shreveport oil-field supply store. The steel and masonry construction includes the office, store, warehouse, and a complete pump shop.

Texsteam Corp. announces

. . . the formation of two sales divisions in Houston and the promotion of company personnel to manage

C. T. Pearson

W. B. Colvin

them. The announcement comes from J. P. Turner, vice president and general manager of Texsteam, a subsidiary of Vapor Heating Corp., Chicago.

Curt T. Pearson, former assistant sales manager of the company, was appointed sales manager of the newly formed heater and steam generator division. He has been with the company 7 years.

William B. Colvin was named sales manager of the new pump and valve division. Colvin has been public relations manager of Texsteam since 1957.

Armco Argentina appointed

. . . to represent National Supply Co. in the sale of oil-field machinery and equipment and tubular products in Argentina. The announcement was made jointly by A. R. Meyer, vice president of National who is in charge of the company's export division, New York; and A. R. Edwards, president of Armco International Corp., Middletown, Ohio.

Armco Argentina S.A. Industrial y Comercial was established in 1938 as an Argentine corporation. It is a wholly owned subsidiary of Armco International Corp.

Companies combine offices

. . . in New Orleans' new Tulane building. The firms involved—W. Horace Williams Co. and McWilliams Dredging Co.—are each divisions of Williams-McWilliams Industries, Inc. The two concerns also announced that the management of the company has been returned to the operating personnel in New Orleans.

Haskell (Inky) Wotkyns appointed

Haskell Wotkyns

. . . special representative for American Iron & Machine Works Co., Inc., Oklahoma City.

Wotkyns previously was executive vice president of Maloney - Crawford Tank & Mfg. Co., Tulsa. Before that he was Mid-Continent sales manager of Abegg & Reinhold Co., Houston.

Wotkyns, who will headquarter in Tulsa, will cover the Mid-Continent oil-field area and will work in both domestic and export sales.

Axelson Division promotes eight

. . . to newly created regional sales manager posts, according to L. G. Evans, general sales manager.

The promotions involved: C. W. Duplissey, Gulf Coast; L. E. Johnston, Canada; C. S. Kyle, Kansas and Oklahoma; P. I. Layman, West Texas and New Mexico; J. P. Nielsen, Rocky Mountain; P. A. Puckett, Illinois and Eastern; Dolph Witzel, California; and C. M. Worley, Southern district. Axelson is a division of U. S. Industries, Inc.

Bethlehem Steel division to have

. . . a New York sales office to cover both domestic and export sales, announces C. R. Zimmerman, vice president of Bethlehem Steel Co.'s Supply Division.

I. C. Smith will be transferred to New York to handle the coverage in this important area. Smith, a native of Long Island, graduated from Lehigh University in 1935. He has held important positions in both manufacturing and sales during his service with Bethlehem and in his present assignment he will be opening a new field of operations which will expand the Supply Division's service to the oil industry.

At the same time it was announced that J. V. Spalding will be transferred from Houston to Tulsa as general manager of sales, Supply Division.

F. E. (Bake) Sandefer is promoted

. . . from area service manager to division manager of Houston Oil Field Material Co.'s Four Corners division. He will have charge of sales and services and will headquarter at Farmington, N. M. Sandefer's assistant will be Jack E. Lindell.

F. E. Sandefer

Examining new V-belt

Lowell Kessler, manager of product application at Gates Rubber Co., discusses the new HC V-belt with executive vice president Charles C. Gates, Jr. The product permits advance in V-belt drive design, with major savings in space and weight.

Ned C. Stearns is named

Ned C. Stearns

. . . sales manager of Irish Engineering Service, Shreveport, La. He formerly was associated with a pipe-coating manufacturer as field-service representative and salesman. He served more than 4 years with D. E. Stearns Co. as sales manager and is a veteran of more than 24 years in the oil and gas industry.

W-K-M announces new policy

. . . of appointing independent concerns as authorized repair shops for the W-K-M through-conduit gate valves. The first companies appointed are Barron Machine & Supply, New Iberia, La.; Slim LaGrone Co., Odessa, Tex.; and Blue & Gray Supply, Lafayette, La.

Any "on the line" repair service where the valve is under pressure will continue to be done by W-K-M's own servicemen. A service school has been set up for personnel of the new repair shops under the direction of Jim Harbison, W-K-M service manager. W-K-M is a division of ACF Industries, Inc.

John L. Tullis is named

. . . president and general manager of J. B. Beaird Co., Inc., a subsidiary of American Machine & Foundry Co. He will also head Beaird International, Inc., and Phoenix Corp.

J. L. Tullis

He entered the company 12 years ago as general manager of sales and was advanced to vice president of sales in 1954. Three years later he was appointed executive vice president and a board of directors member.

Tullis succeeds Pat Beaird, son of the company's founder and president since 1939. Beaird announced his resignation in order to devote full time to outside interests, but will remain as a company director and as a member of the board of directors of American Machine & Foundry Co.

W. W. Hicks is appointed

. . . truck dealer by Four Wheel Drive Auto Co., Clintonville, Wis., announces G. F. DeCoursin, vice president in charge of marketing. Hicks will make his headquarters at FWD's sales and service center in Duncan, Okla. He has been associated with oil-field operations for 31 years, the last 12 of which in selling for Gates Rubber Co. and Cardwell Mfg. Co.

Wolverine Tube announces

. . . changes in its field-sales staff and district organization and the appointment of four more district sales managers. Jack H. Smith, Wolverine's manager of field sales, made public the following changes:

Richard B. Flynn

Carl T. Fuller

Richard B. Flynn, former East Central district sales manager is now sales manager of the Cleveland district. Carl T. Fuller, former sales manager

Philip MacKay

G. W. Overstreet

of the Southwestern district, is now sales manager of the Chicago district.

Philip MacKay was promoted from sales representative in Philadelphia to sales manager in that district. George W. Overstreet, Eastern district's representative, is now sales manager of the Dallas district.

E. J. Campbell

T. F. Vigmostad

Edmund J. Campbell, Midwestern district's sales manager, takes over as sales manager of the Detroit district.

Richard C. Cash

Fred F. Moore

T. F. Vigmostad, former sales representative in the Midwestern district, is now sales manager of the St. Louis district.

Richard C. Cash, former Southwestern district sales representative, was promoted to sales manager of the Birmingham district. Fred F. Moore will remain as sales manager of the New York district.

Howe-Baker Engineers, Inc. announces merger

. . . with National Aluminate Corp., according to G. B. Hanson and C. H. Black, president and vice president respectively of Howe-Baker.

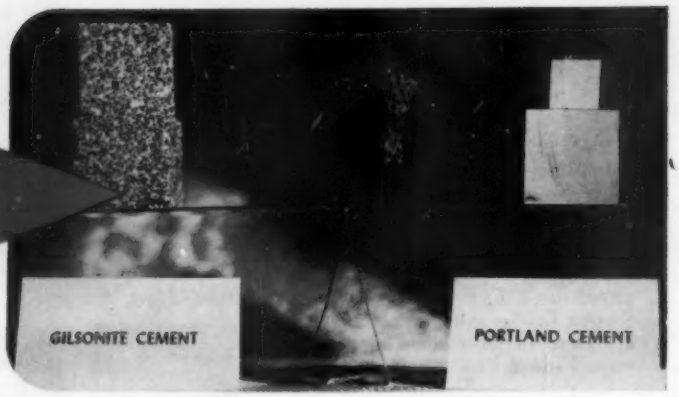
Hanson, a recognized authority on electrical precipitation, has been connected with the oil industry during all of his business life. Black has been Howe-Baker vice president since 1946. He formerly was with Reed Roller Bit Co. for 6 years.

G. B. Hanson

C. H. Black

Howe-Baker Engineers, Inc. has moved its operations to these quarters in Tyler, Tex. The building contains research laboratories and general offices.

GILSONITE CEMENT...



"ANOTHER FIRST BY HALLIBURTON"

In typical Halliburton tradition . . . another "first" has been introduced to the oil industry for better well cementing operations

Gilsonite Cement has been successfully field-proven for:

- high fill-up cementing
- multiple stage cementing
- plug back operations for lost circulation
- setting production liners in gas wells with weak formations

★ WHAT IS GILSONITE?

A new light weight additive (sp.gr. 1.07) that will produce a low density cement with slurry weights down to 10 lbs./gal.; adding volume, *NOT* weight to slurry. Gilsonite is unlike any other known material and is an excellent lost circulation additive for cement. It is milled and graded to correct particle size for this particular field use. It is generally used with portland cement, with or without Bentonite, Pozmix or Pozmix 140.

★ PROPERTIES OF GILSONITE...

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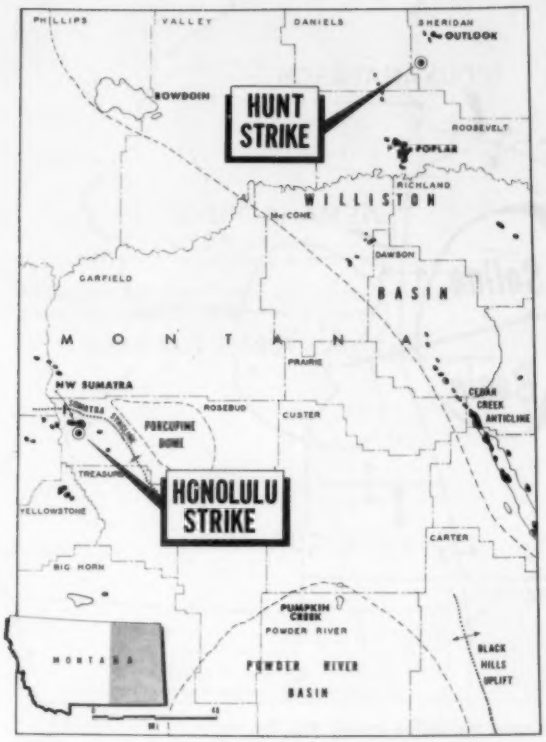


TWO NEW DISCOVERIES have climaxed a busy exploration year for Montana. Indications are that 1959 will bring even more attention to the state.

Montana has that golden look for 1959

BY FRANK J. GARDNER

LOOKING FOR AN OIL FIELD? Try eastern Montana. Or western Montana. Or Central Montana. Just try Montana. Interesting discoveries are popping up all over that state, and it's a number one candidate for special interest in 1959.

Two recent strikes in the eastern half of the state underscore Montana's potential. They're 200 miles apart and in different geologic provinces.

From the west . . . In the northwest corner of Rosebud County, Honolulu Oil Corp. has uncovered a rich Tyler-Mississippian field at its 1-11 Stensvad, in Section 11-11n-31e. The well flowed 1,116 bbl. per day of 34° oil on a 2-hour test of Tyler perforations at 5,308-80 ft. Choke size was 1½ in. and there was no water. On an earlier drill-stem test of the interval 5,323-90 ft., flow was at a rate of 38½ bbl. per hour. Honolulu is still testing its find, with total depth at 5,516 ft. Obviously, 11 is the operator's lucky number, with well 1-11 in Section 11-11n-31e turning in an 1,116-bbl. daily performance.

This fine new discovery lies about 2 miles west-northwest of the nearest production at Northwest Sumatra field in Township 11n-32e. Northwest Sumatra produces not only from the Tyler, but from the Amsden and Piper-Pennsylvanian as well; there are two productive sands within the Tyler—the "A" and the "B". Honolulu's discovery is flowing from the "B" pay, but had good oil shows in "A" as well, and possible oil in the Amsden.

Logically, then, we can look forward to another multipay field around the 1-11 Stensvad. Honolulu has three offsets in the works, and McAlester Fuel Co. is in the pay sand already at its 1-A Montana Federal, in Section 12.

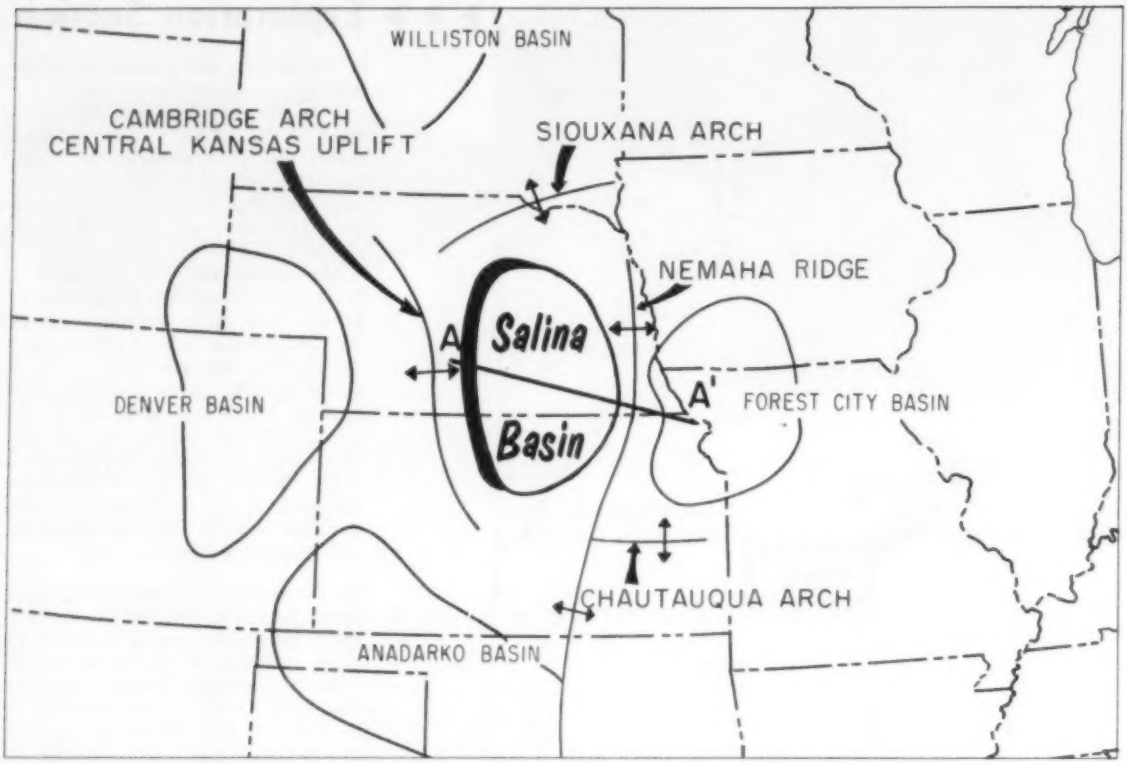
The McAlester well recovered 1 ft. of free oil and 540 ft. of oil-and-gas-cut mud on a drill-stem test of the "A" sand at 5,298-5,309 ft., and the operator has run casing; it is a northeast offset to the discovery, and is about 100 ft. low to it. An unsuccessful test was run in the "B" pay at 5,428-40 ft. McAlester has staked a second well, the 1-B Government, southeast of the 1-11 Stensvad; this one lies between the new discovery and Northwest Sumatra field.

To the east . . . Jumping 200 miles to the northeast, we find a new Williston basin field opened at the H. L. Hunt 1 Hagan et al. in Section 7-34n-52e, Sheridan County. This one was an old 9,482-ft. dry hole drilled by Hunt in 1952. It was looking for Mississippian pay, and although it reached Ordovician, that formation was not adequately tested, nor was the Devonian. Hunt reentered the hole, drilled it deeper (to 10,695 ft.), and after an extensive period of testing, acidizing, and fracturing, has finished it as a 100-bbl. pumper from Winnipegosis-Devonian at 9,392-9,416 ft.

Here's an example of an abandonment that would have made a producer in earlier days if our new methods and techniques had been on hand then. How many more of these old failures can we expect to convert? Probably thousands.

Montana looks good . . . Although it's no gusher, the Hunt discovery should have a stimulating effect on the pre-Mississippian oil hunt in northeastern Montana, northwestern North Dakota, and southern Saskatchewan. The excellent multipay wells in Sheridan County's Outlook field, 8 miles northeast of the Hunt strike, plus successes in Divide County, North Dakota, are ample evidence that there's much to be done in this sparsely drilled region.

So Montana has the golden look for 1959. There's plenty of room to play, and preliminary opinion has it that exploration budgets will be fatter this year. The gloom peddlers who contend we're running out of places to look for oil had better take a look at a wildcat map of the state. It's pretty blank.



MAJOR GEOLOGIC FEATURES of Nebraska and Kansas near the Salina basin. Fig. 1.

Where is the oil in Nebraska's Salina basin?

BY STUART C. TAPP
Geologist,
Superior Oil Co., Denver

THE SALINA BASIN is one of the few major sedimentary basins in the United States that remain virtually untested. Approximately 240 wells have been drilled and only 100 have penetrated the entire sedimentary section.

This exploration effort has led to the discovery of four small oil fields, all located in Harlan County, Nebraska, and all producing from the Lansing-Kansas City group of middle Pennsylvanian age.

Geographically, the Salina basin is located in eastern Nebraska and North Central Kansas (Fig. 1). Structurally, it is bounded on the north by the Siouxana arch, on the east and south by the Nemaha uplift, on the south and the southwest by the Cambridge arch-Central Kansas uplift. The geologic province map shows its position relative to other basins of the Mid-Continent and Rocky Mountain area. The Salina basin of Nebraska covers 36,000 sq. miles and is roughly equivalent in size to the Colorado portion of the Denver basin.

The cross-section in Fig. 2 (A-A' on Fig. 1) runs from Dawson County, Nebraska to Doniphan County, Kansas. It is approximately 250 miles in length, and is a west-to-east traverse through the central portion of the basin. The major structural features from west to east are the Cambridge arch-Central Kansas uplift, the Salina basin, the Nemaha granite ridge with the Humboldt fault on its eastern side, and the Forest City basin. The dotted lines represent major unconformities.

About the author . . .

S. C. TAPP

For the past 7 years, the author has worked on subsurface problems in the Mid-Continent and Rocky Mountain areas, for Superior Oil Co. of California. He is at present a staff geologist with Superior in Denver.

Stratigraphy

The Precambrian rocks in the Salina basin are composed of pink feldspathic granite, brown quartzites, and red clastics.

The Precambrian is unconformably overlain by the Arbuckle group of Cambro-Ordovician age which may be divided into the Bonneterre, Eminence, Gasconade, Roubidoux, and Jefferson City. The Bonneterre is a buff-to-gray, sandy, shaly, dolomite. The Eminence is a cherty dolomite. The Gasconade is a cherty dolomite with a sandstone member at its base. The Roubidoux is a very sandy, slightly cherty dolomite. The Jefferson City

MISSISSIPPIAN strat traps are widespread as shown by shaded areas.

HUNTON possibilities are seen primarily on basin's east flank.

VIOLA potential is noted on both flanks of the basin.

SIMPSON is favorably indicated on east and west perimeters.

Is this the strat oil?

THESE MAPS illustrate mappable stratigraphic traps. The stratigraphic traps which are shown are formed by truncation of section during early Pennsylvanian time with subsequent overlapping by younger Pennsylvanian beds. The zero line, or updip edge of each trap was delineated by applying the individual contour map of each Paleozoic horizon to the unconformity map drawn on the base of the Pennsylvanian system. The downdip extremity of each trap was mapped at the spill point of the unconformity map and the previously drawn zero horizon lines.

Map F is a composite of all traps. It is obvious that several traps lie over each other. This map shows areas where at least one and in some cases, four stratigraphic traps may be found. On the eastern flank of the Cambridge arch stratigraphic traps of the Viola, Simpson, and Arbuckle may lie over each other. On the western flank of the Nemaha uplift stratigraphic traps of the Mississippian, Hunton, Viola, and Simpson lie over each other.

It was stated earlier that these traps were formed as a result of truncation of section during early Pennsylvanian time with a subsequent overlapping by younger Pennsylvanian beds. However, it is possible to map other types of stratigraphic traps. For example, updip permeability pinchouts of Cherokee sandstones, pinchouts of porous Lansing limestone, etc.

ARBUCKLE interest is focused on areas near Grand Island and Omaha.

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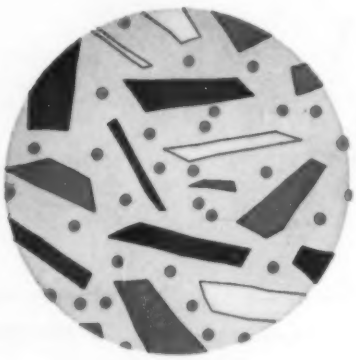
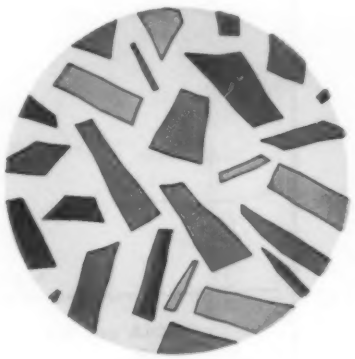
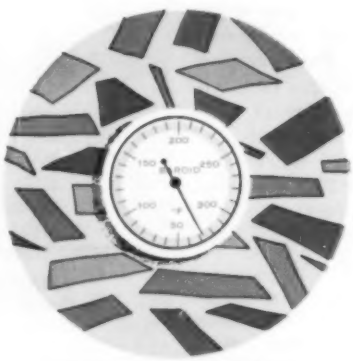


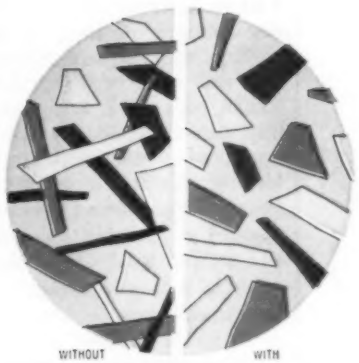
MAINTAINS GOOD EMULSIONS



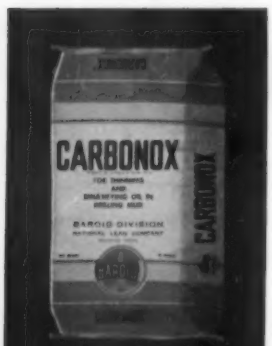
THINS MUD WITHOUT DILUTION



KEEPS MUD STABLE AT HIGH TEMPERATURE



RESISTS EFFECTS OF SALT WATER



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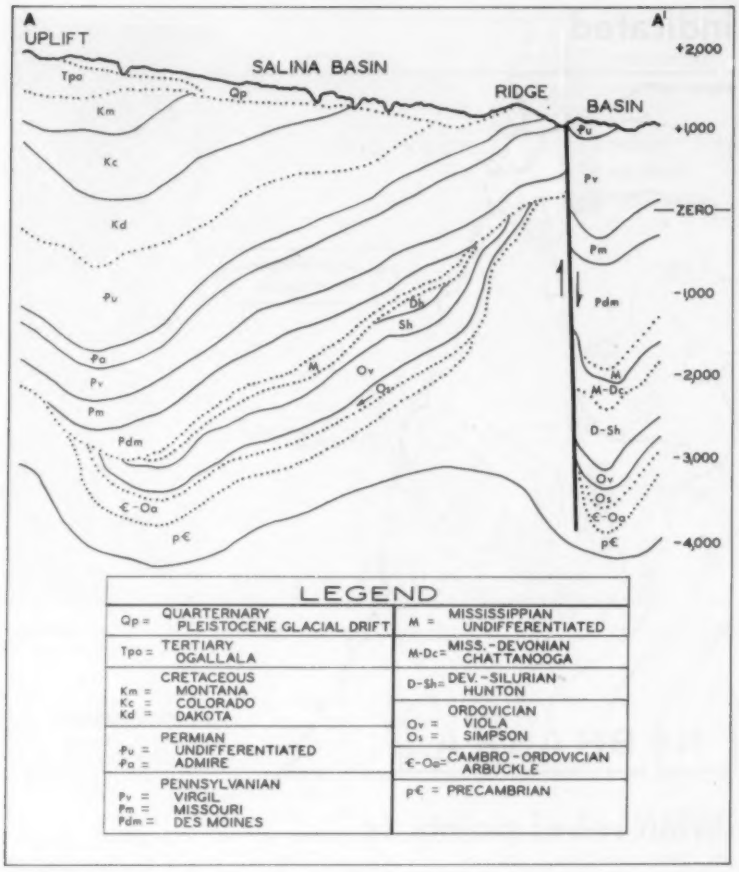


CROSS-SECTION A-A' is a west-to-east line across the Salina basin (see first illustration) from the Central Kansas uplift to the Forest City basin. Fig. 2.

is a gray to tan, finely crystalline, cherty dolomite. Since the top of the Arbuckle is erosional, the uppermost dolomite may be Jefferson City of lower Ordovician age or it may be as old as the Bonneterre dolomite of upper Cambrian age.

The dolomites of the Arbuckle group are the most prolific oil producers in Kansas and may reach a thickness of 300 ft. A combination of structural and stratigraphic conditions provides for this accumulation and entrapment of petroleum.

The Ordovician system is represented by the Simpson group and the Viola formation. The Simpson group can be divided lithologically into a green waxy shale, a clean coarse-grained sandstone which is typical St. Peter sandstone, and tan dolomite. The Simpson interval may be 150 ft. thick. The Viola formation is a tan, coarsely crystalline dolomite that reaches a maximum thickness of 300 ft. Both the Simpson and Viola produce oil in the Dawson field of Richardson County, Nebraska.

The Ordovician is conformably overlain by Siluro-Devonian carbonates of the Hunton group. The Hunton is comprised of white-to-tan limestones and dark gray-to-brown dolomites. Its maximum thickness is over 700 ft. on the western flank of the Nemaha ridge about 40 miles north of the line of the cross-section. The Hunton produces oil in the Shubert, Barada, Dawson, and Falls City fields of Richardson County, Nebraska, in the Strahm and Sabetha fields of Nemaha County, Kansas, and in the Livingood field of Brown County, Kansas. All Hunton production appears to be structurally controlled.

This Mississippian consists of cherty limestone, with its top being weathered to varying degrees, and usually a shale at its base. Noticeable is a thicker light-gray interval in the Forest City basin. The reason for this is that the Forest City basin has a thick Chattanooga section, while the Salina basin through the line of this cross-section has no Chattanooga. It is generally believed that the Chattanooga thinned rapidly to the west, was deposited over the present Nemaha ridge, then beveled by post-Mississippian erosion. In the Salina basin the Mississippian limestone has a maximum thickness of 120 ft. Shows of oil and gas are generally confined to erosional strata of weathered chert at the top of the Mississippian.

The Pennsylvanian system has been separated into the Des Moines, Missouri, and Virgil series. There is a major unconformity between Pennsylvanian sediments and older rocks. Farther southwest in Kansas, the unconformity is evidenced by encountering up to 200 ft. of conglomeratic red and green shale before penetrating pre-Pennsylvanian sediments.

The Lower Pennsylvanian - Des Moines series is composed of the Cherokee and Marmaton groups. The Cherokee group has sandy shales, sandstones, and coaly deposits while the Marmaton group is dominantly limestone and interbedded shale.

The Missouri series is composed of the Pleasanton and Lansing-Kansas City groups. This Middle Pennsylvanian zone is the oldest sediment to overlie the Precambrian on the Nemaha ridge on the line of this cross-section. The thickness of the Lansing-Kansas City group is approximately 200 ft. Zones of oolicastic porosity 10 to 20 ft. thick and thinner zones of intercrystalline porosity are present within this limestone interval. The Lansing - Kansas City group produces in Harlan County, Nebraska, and immediately south, from 28 fields in Phillips County, Kansas, from structurally controlled traps.

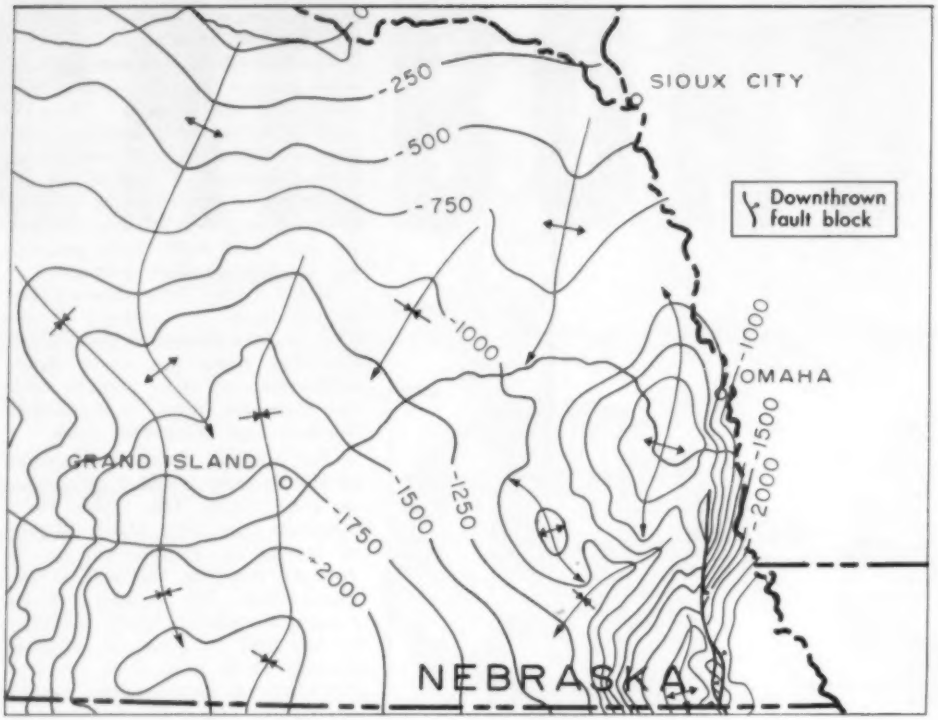
The Virgil series is composed of the Douglas, Shawnee, and Wabaunsee groups. Lithologically, these groups are sandy shales, thin sandstones, and some well-defined porous limestones.

The Permian has been split into the Admire group, which is fairly constant in thickness throughout the Salina basin and an upper undifferentiated zone. The Admire group contains an alternating sequence of dense gray limestones and red shale. The upper undifferentiated zone includes the Council Grove and Chase groups, the Wellington and Ninnescah shales. This is the typical Permian section of the Mid-Continent region. It is composed of anhydrite and anhydritic red shales interbedded with hard, dense limestones. The Permian is usually barren of oil and gas shows in this area.

The Permian system is unconformably overlain by the fairly thick Cretaceous system. The Cretaceous has been subdivided into the Dakota, Colorado, and Montana groups.

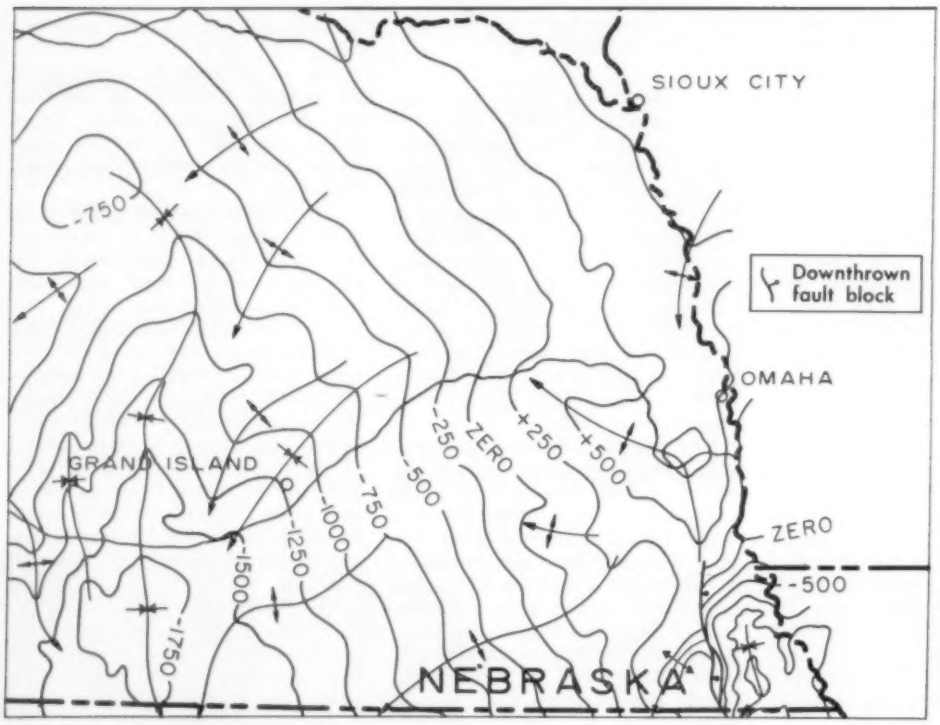
The Dakota group is a sand-shale sequence similar to that present in the extreme eastern portion of the

Structural oil may be indicated . . .



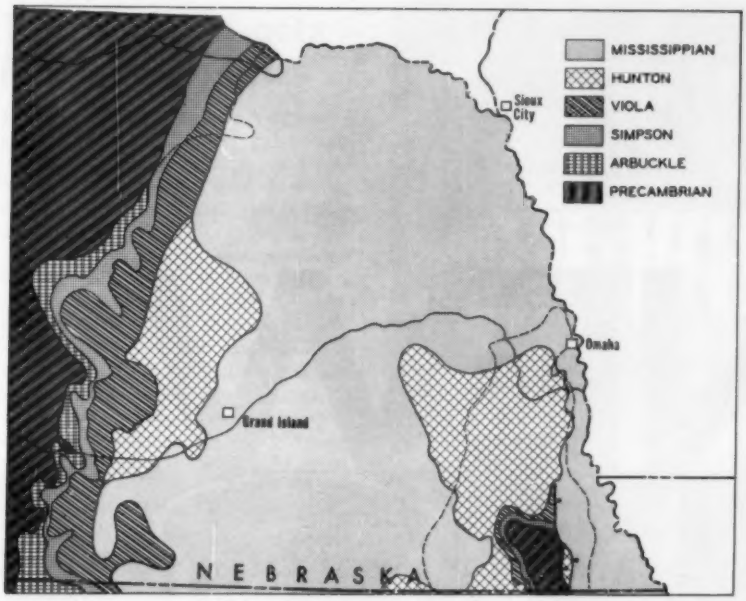
PRECAMBRIAN contours reveal structural aspects of Salina basin. Fig. 3.

. . . where the Precambrian relief points to . . .



PENNSYLVANIAN unconformity displays general expression of deeper horizon with features less pronounced. Fig. 4.

. . . structures in the younger beds above



PALEOGEOLOGIC DISTRIBUTION indicates the subcrop pattern of the pre-Pennsylvanian formations. Fig. 5.

Denver basin. Where the Dakota sands are well developed they are water-saturated although a few wells have noted some dead-oil staining.

The Colorado group is made up of the dark-gray Graneros shale, the mottled cream-to-white Greenhorn limestone, the dark-gray Carlile shale, the marly Fort Hays limestone, and the calcareous gray shales of the Niobrara formation.

The Montana group is represented here by the dark-gray Pierre shale.

The Cretaceous is unconformably overlain by the buff-to-pink, sandy claystone of the Tertiary Ogallala formation in the western third of the cross-section. In this area a Pleistocene glacial drift unconformably overlies the Tertiary, Cretaceous, and part of the Permian. This glacial drift is an unsorted mass of clay, silt and boulders.

Structures

Fig. 3 is a structure contour map drawn on top of the Precambrian rocks. The contour interval is 250 ft. Shown are the anticlinal axes, the synclinal axes, and the Humbolt fault on the east side of the Nemaha uplift.

The Precambrian surface shows the most structural relief of this group of maps. Incidentally, the Humbolt normal fault has over 3,000 ft. of displacement on the top of the Precambrian.

Fig. 4 is a contour map drawn on the unconformity at the base of the Pennsylvanian system. Again the Humbolt fault is present. The long syncline at the western edge of the map is the axis of the basin, and has shifted westward with reference to the Precambrian map.

Fig. 5 represents the pre-Pennsylvanian paleogeologic surface and shows the subcrop pattern of pre-Pennsylvanian formations. In the center of the map and to the north is Mississippian limestone. The Hunton group subcrop is seen on the west and on the east.

The Viola formation is truncated by the Pennsylvanian in a long north-south strip. The Simpson group subcrops on the eastern flank of the Cambridge arch and in a thin ribbon on the western side of the Nemaha uplift. Only on the western side of the Salina basin is the Arbuckle group onlapped by Pennsylvanian sediments.

The dashed line in the north and in the east is the Arbuckle subcrop line and represents the subcrop pattern where the Arbuckle is covered by pre-Pennsylvanian sediments. The area in Holt County, Northeast Nebraska, could have been just high enough to prevent the influx of Arbuckle seas as it was in the Nemaha area. On the other hand, in the west, the Arbuckle was laid down almost as a blanket deposit, but was stripped off by later uplift and erosion.

It is evident (1) that structural anomalies exist in the Salina basin, (2) that major unconformities are present in a complete Paleozoic section, (3) that numerous regional stratigraphic traps can be mapped, and (4) that porosity and shows have been recorded in all the possible Paleozoic reservoirs within the basin. These, and the fact that the Lansing, Mississippian, Hunton, Viola, Simpson, and Arbuckle all produce oil in nearby areas at depths of 5,000 ft. or less, leads to the conclusion that the Salina basin has definite oil possibilities and must be considered a possible future oil and gas province.

Bandini suspends San Emidio test

IN CALIFORNIA, Bandini Petroleum Co. plugged and suspended oprations on its wildcat located 1½ miles northwest of the producing area at San Emidio Nose field. Bandini made the decision to suspend following electric logging in the 12,656-ft. wildcat.

California highlights . . . Roy Gill has quit the 6,550-ft. Forster near the famed San Juan Capistrano Mission in Orange County . . . Operators on the 5,708-ft. 1 Barbara on the Mexican border in Imperial County have suspended drilling . . . The Texas Co. plugged and abandoned a 10,026-ft. gas test 3 miles east of the River Island gas field in San Joaquin County.

Wildcat pair hints pool finds

TWO NEW POOL discoveries were indicated by a pair of wildcats being drilled by Kern Oil of California, Ltd., and Standard Oil Co. of California on opposite sides of North Tejon field.

The one attracting the most interest is Standard's 338-9 Universal Consolidated—S.P., 1½ miles north of the field. Standard and Universal Consolidated Oil Co. jointly hold 480 acres in the area.

On formation test of the interval 7,858-7,900 ft., the wildcat flowed at a rate of 500 bbl. daily. Oil surfaced in 1 hour, 24 minutes, with a medium-to-strong blow of gas.

The operator was coring ahead. Other companies with interests in the immediate area include Union Oil Co. of California, Superior Oil Co., Reserve Oil and Gas Co. and Franco Western Oil Co.

The Kern Oil of California wildcat, 81 KCL, is located ¾ mile south of the Highway area of North Tejon field. The operator was running casing to 11,342 ft. and plans to test the Eocene before trying for a new pool completion in the Z-6 Miocene zone.

NEW

MARK I

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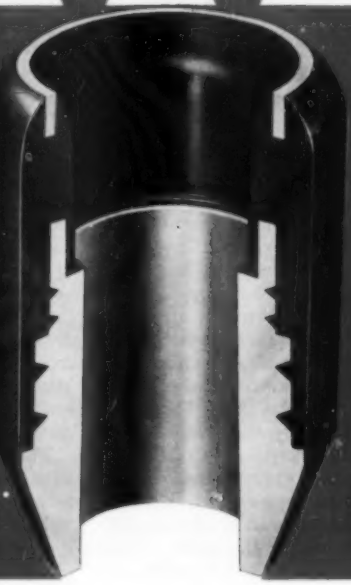

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Companion to the Proved E-Z Swab, the new Mark I Cup Swab uses the same mandrel but different rubbers. Mark I is a heavy duty positive displacement type swab able to lift a fluid load of from 1,200 feet to the heaviest loads encountered. Mark I was designed for use where the unique features of the E-Z Swab are not required. Heart of the Mark I—see cutaway—is a solid steel reinforcing core. This solid steel core can't wear, bend, and break as conventional reinforcing wires can. Can't hang up in tubing the way wires can. The new Mark I falls fast and comes out full. All this and the famous Mission Guarantee: "In a competitive test it will outperform all others or your money back." Order through your favorite supply store. Get your copy of the new brochure.

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59-300

Texas' Nolan gets four pay zones

THE NENA LUCIA AREA of southwestern Nolan County gained its fourth pay zone, Wolfcamp, at Humble Oil & Refining Co. 4 Jameson. Regular pays are Strawn reef, Caddo and the Ellenburger.

Completion in the new-pay zone was for 36 bbl. of 44° oil a day, on the pump, from perforations at 6,038-43 and 6,048-52 ft. Top of the pay was picked at 6,036 ft., on elevation of 2,347 ft. This section was reported earlier as the Jameson pay.

No. 4 Jameson is a dual completion, and a west extension to Strawn reef production. Location is 14 miles southwest of Maryneal, in Section 88, Block 1-A, H&TC Survey.

Texas workover makes small well

RECOMPLETION of a 4,005-ft. dry hole 5 miles northeast of Mertzon in Irion County has resulted in a small San Angelo discovery.

The well is Tucker Drilling Co., Inc., 1 Henry Cravens, Section 25, Block 2, H&TC Survey. Final potential was 9 bbl. of 31° oil a day. Nearest San Angelo production is 3½ miles to the northwest in Lucky-Mag field.

Books for oil finders

TEXAS

TEXAS Oil and Gas Handbook is a new publication offered by R. W. Byram & Co., Drawer M, Capitol Station, Austin.

The book explains how the Texas Railroad Commission functions as the conservation board for the state, and is intended to serve as a guide to the elementary procedures necessary to the production and transportation of oil and gas.

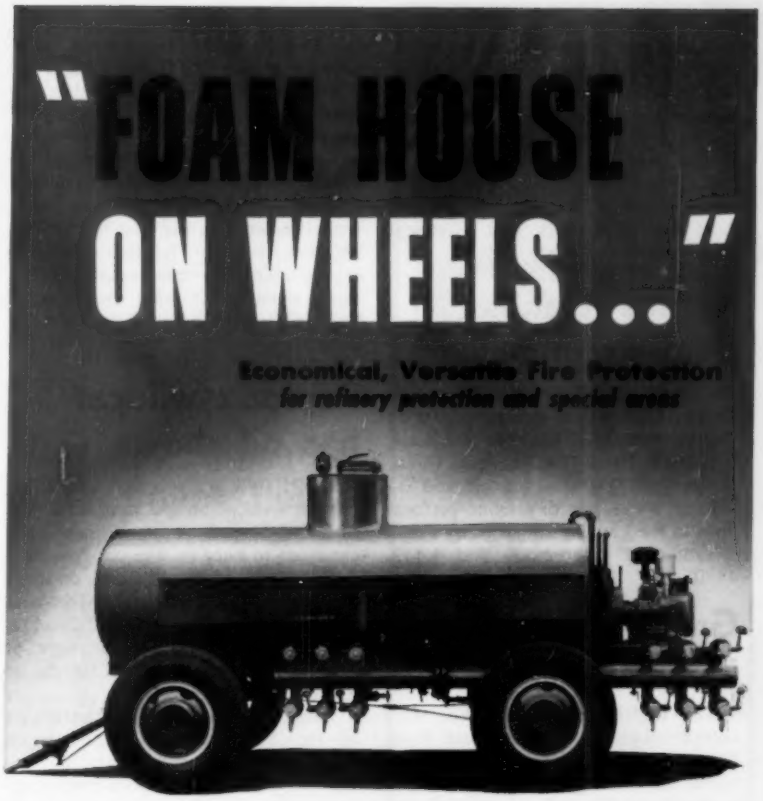
All types of reporting forms are explained, and illustrated with typical forms made out.

There is a chapter on the organization and general operation of the commission, in addition to its various rules and regulations.

WEST TEXAS

PETROLEUM REVIEW, Garza and Lynn counties, Texas, is available from Phifer Petroleum Publications, P. O. Box 20,024, Houston.

The two-county data book is another in a series of oil and gas-producing counties in Texas. Data in-



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cludes a chronology of field discoveries, and production records by fields.

Data on each field includes the discovery well. Production is carried by year, with number of producing wells, and cumulative production to the end of the year. Status of fields is to July, 1958.

The book is illustrated with electrical logs, field maps, and geological chart for West Texas.

Kansas' Llanos field extended

AN EAST EXTENSION to Northwest Kansas' Llanos field was completed by Phillips Petroleum Co. The 4 Llanos, C NE NE 10-6s-37w, Sherman County, pumped 180 bbl. of oil and 34 bbl. of water per day from perforations in the Lansing-Kansas City Pennsylvanian at 4,486-4,503 and 4,442-48 ft.

Green River adds two discoveries

TWO GAS DISCOVERIES were completed in the western Green River basin. Belfer Natural Gas Co. finaled the 1 Emigrant Springs Unit in C SE SE 21-23n-112w, Lincoln County, Wyoming, for 1,881 M.c.f.d. of gas. Production is from second Frontier-Cretaceous at 10,496-10,564 ft.

The other discovery is Belfer's 1 BNG-Larson-McGinnis in NW SW SE 7-26n-112w. It flowed 8,100 M.c.f.d. of gas from Frontier at 7,015-71 and 7,084-7,164 ft. and 7,313-93 ft. The first discovery above was completed as the first test on the 26,800-acre unit. The second discovery is about ½ mile south of LaBarge town and 3 miles southwest of East LaBarge field on the Green River Bent Unit.

Paradox wildcat has oil shows

OIL SHOWS are reported at an important wildcat on the northwest side of Utah's Paradox basin—a new wildcat front to keep an eye on. Amerada Petroleum Corp. found shows on three drill-stem tests below the Moenkopi at 1 State in C NE NE 2-29s-11e, Wayne County. Drilling is now at 2,783 ft. on the way to 3,500 ft. or the Coconino.

Amerada's test is 7 miles northwest of the Tennessee Gas Transmission Co. Sorrel Butte wildcat which is below 4,573 ft. in Hermosa-Pennsylvanian.

Roads built into Berland River area

ROADS are being built into a new location in the Berland River area of Alberta. Pan American Petroleum Corp. will drill A-1 Berland River on LSD 10, 32-58-25w5, 12 miles due west of the British American-Shell Berland River gas discovery.

The well will go to the Devonian, pay at the discovery well which is Canada's biggest gasser and thickest reef find.

Five wildcats set for Alberta field

FIVE WILDCATS were staked in the general Swan Hills-Morse River area of Alberta last week by Pan American Petroleum Corp. and British American Oil Co., Ltd.

The new locations are near the recent oil discovery made by the team. These rigs will drill at the following locations: Pan American-British American A-3 Swan Hills, LSD 10, 21-66-10w5; A-9 Swan Hills on LSD 10, 22-66-10w5; A-35 Swan Hills on LSD 10, 28-66-10w5; A-60 Swan Hills on LSD 10, 32-66-10w5; and

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THE OIL AND GAS JOURNAL

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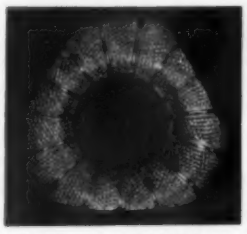

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A-24 Swan Hills on LSD 4, 34-66-10w5. The discovery well is A-1 Swan Hills 14-33 on LSD 14, 33-66-10w5.

First Custer try set in Oklahoma

PRODUCTION tests have begun at a deep discovery prospect in Custer County, western Oklahoma. Magnolia Petroleum Co. will try to give this county its first production at 1 Miller in C SE NW 22-15n-16w.

Tests are under way at 16,725-90 and 16,950-72 ft. in the Arbuckle-Cambro-Ordovician. Lop tops are: second Morrow-Pennsylvania at 11,-510 ft.; Chester-Mississippian at 11,-792 ft.; Merameck-Mississippian at 13,080 ft.; Woodford-Mississippian at 14,258 ft.; Hunton-Siluro-Devonian at 14,386 ft.; Sylvan-Ordovician at 14,-823 ft.; Viola-Ordovician at 14,920 ft.; Simpson-Ordovician at 15,420-15,628 ft.; dolomite at 15,850 ft.; and Arbuckle at 16,072 ft.

Sooner well taps Pennsylvania pay

ANOTHER Pennsylvanian oil pool in the Northeast Cheyenne Valley area of northwestern Oklahoma appears to be in the mill. J. M. Huber Corp. 1 Case, C SW NW 7-21n-14w, southwest of the pool, flowed 105½ bbl. of oil in 5 hours on 24/64-in. choke from Cherokee sand at 7,052-92 ft.

On 30/64-in. choke the well made 60½ bbl. in 3 hours, 158 bbl. in 11 hours, and an average of 14 bbl. hourly on 4-hour test. Location is in Major County.

Operators suspend Oregon wildcat

THE 10-FARMER SYNDICATE drilling Barr in Linn County have suspended operations at 4,529 ft. until after the holidays.

Testing will be resumed in early January.

Ohio's Creston field production extended

An extension south of Leroy in Creston field, Ohio, with an initial production of 100 bbl. was reported by Burton and King. Their 1 Wm. Lintner, Lot 29, Westfield Township, Medina County, gaged 1,200 M.c.f. after fracture, in addition to the oil, from Clinton at 3,057-65 ft.

Wildcat hits in Green River basin

MORRISON-JURASSIC oil production is reported at a wildcat on the south end of Green River basin's big Rock Springs uplift. Caulkins Oil Co. 2-8 Federal, C SW NW 8-15n-104w, Sweetwater County, Wyoming, flowed at the daily rate of 163 bbl. from perforations at 4,038-43 and 4,122-28 ft. on ½-in. choke.

Gas flowed with the oil which was cut 1½% with water. The sand is reportedly 40 ft. thick in the two pay zones.

New pay indicated in Wyoming field

POSSIBLE new-pay production is reported at Rolff Lake field in Fremont County, Wind River basin, Wyoming.

Trigood Oil Co. is coring at 4,922 ft. at the 1 Tribal in C NW SW 21-6n-3w. Earlier reports stated the well found oil on a drill-stem test of the Dinwoody at 4,636-86 ft. Recovery was 2,447 ft. of oil. The field is a Curtis and Phosphoria producer.

Arizona's Apache gets dry hole

NORTHEASTERN ARIZONA'S Apache County got a dry hole last week at Humble Oil & Refining Co. E-2 Navajo, C SW NE 9-41n-28e.

Humble took this Black Mesa basin wildcat to 6,501 ft. They plugged back to 4,950 ft. Several tests were run but no commercial shows were reported. Location is 1 mile west of the E-1 Navajo, completed last October as the state's biggest oil well for 562 bbl. per day from Pennsylvanian.

Pay zone at that well was 4,594-4,644 and 4,726-72 ft. in the Hermosa. Location is 15 miles west of Four Corners and 2 miles south of the Utah line.

Kentucky well is gas completion

ON TRACE FORK of Licking River in Magoffin County, Kentucky West Virginia Gas Co. have completed 6457 Dora Hale as a shallow Pennsylvanian Salt sand gas well.

Three zones of production were picked up at 1,426-34 ft. total depth, where a natural open flow was recorded of 684 M.c.f.d. of gas. A 24-hour rock-presure test showed 348 pounds.

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Here's action in Illinois basin

ONE of the Illinois basin's best new producing areas is 6 miles north of the town of Harrisburg in Saline County, Illinois. Kewanee Oil Co. opened the field last summer at 1 Harris in SW SW SW 10-8s-6e, for 40 bbl. of oil and 60 bbl. of water per day. Production was from Paint Creek sand at 2,738-54 ft.

The second well, 2 Harris in NW NW NW 15-8s-6e, was a good well, making 550 bbl. per day, natural, on ¾-in. choke from the Aux Vases at 2,947-72 ft. Then Louis Kapp completed the 1 Tate unit in NE NE NE 16-8s-6e, Saline County, for 1,488 bbl. per day, natural, on ½-in. choke, from Aux Vases at 2,944-76 ft. The boom continued with the 2 Tate Unit in SW NE NE 16-8s-6e. This one made 696 bbl. per day, natural, on 7/64-in. choke from Aux Vases at 2,946-66 ft. Another well in the area was completed recently by Slagter Producing Co. at 1 Glen Elder in NW NE SE 14-8s-6e. This one made only 65 bbl. per day, but was completed in a new pay, the Renault at 2,925-29 ft.

Other basin news . . . In Daviess County, western Kentucky, Cox Drilling Co., et al., have a discovery at 1 Homer Gordon in 13-0-27, near West Louisville. This well is being put on pump after swabbing 100 bbl. of oil in 12 hours from Benois-Bethel sand at 1,908-20 ft.

In Henderson County, Kentucky, Universal Operating Co. found a new-pay discovery at 1 J. W. Porter in 22-0-25, 2½ miles south of Euterpe. The operator set casing to test Jackson sand at 1,925-45 ft. A drill-stem test at 1,932-43 ft. got 1, 806 ft. of oil and 120 ft. of mud-mixed oil.

Colorado wildcat hits Dakota pay

DAKOTA-CRETACEOUS gas production was opened at a southwestern Colorado wildcat on the north side of the San Juan basin. This discovery is another addition to the growing list of deep producers in this Four Corners basin.

Val R. Reese 1-35 Bascom, SE NW NW 35-33n-11w, 4 miles from Dakota production, flowed 2,898 M.c.f.d. of gas from perforations at 7,937-70 ft. Flow was on a ¾-in. choke. Absolute open-flow potential, calculated, is more than 32 M.M.c.f.d.

North Dakota bits still probe deep

BEAVER LODGE FIELD'S deep push will continue in 1959.

Amerada Petroleum Corp. announces locations for four Silurian tests at the North Dakota giant: The 1 Iverson-Ramberg in E½ SW 7-155n-95w, the 1 Kvam-Peterson-Svor unit in S½ NE 18-156n-95w, the 1 Moeller-Westburg Unit in C NE 23-155n-96w, and the 1 Herfindahl-Davidson Unit in C NE 35-156n-96w.

Current deep activity at Beaver Lodge includes two deep tests drilling and one shut in.

Montana sets five-well project

A FIVE-WELL PROGRAM is slated for Montana's Petroleum County. Flank Oil Co. will drill the wells in the Cat Creek field area, going to the Otter at from 2,700 to 4,000 ft.

The first well is the 1 Freed in the

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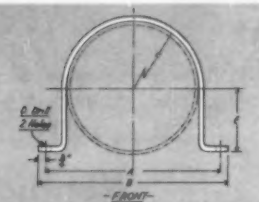

Nom. Pipe Size	A	B	C	D	E
1½	5	6½	1	¾	¾
2	6	7½	1⅜	¾	1
2½	6½	8	1⅞	¾	1¼
3	7	8½	1¾	¾	1½
4	8	9½	2¼	⅞	2
6	10	11½	3¾	⅞	3
8	12½	14	4¼	⅞	4
10	14½	16	5⅜	⅞	5
12	16½	18	6⅜	⅞	6

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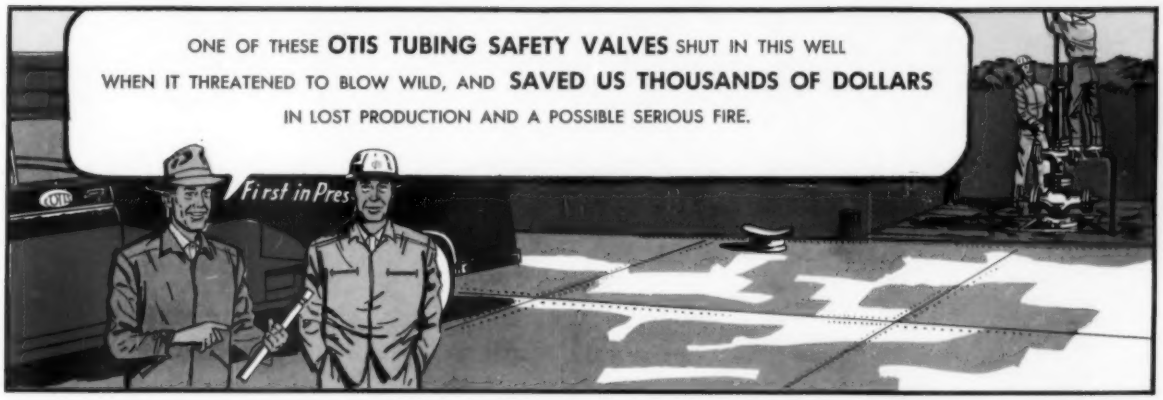
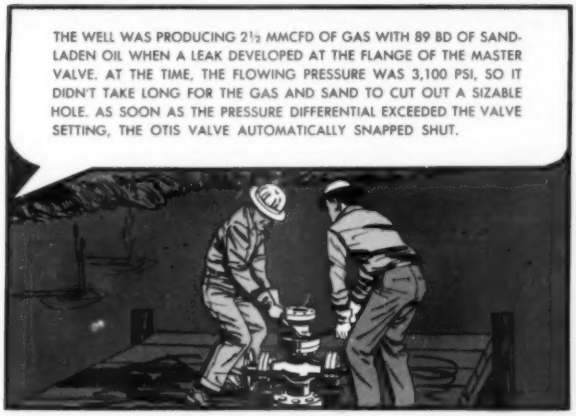
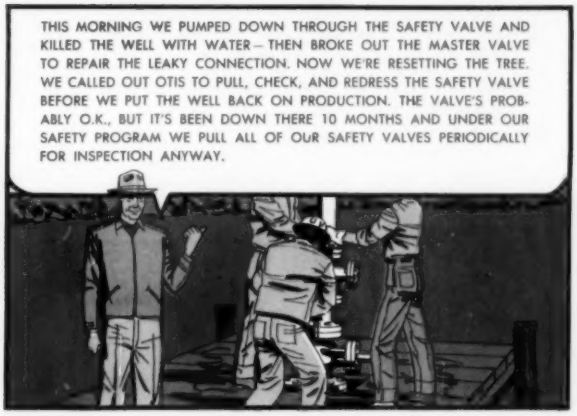
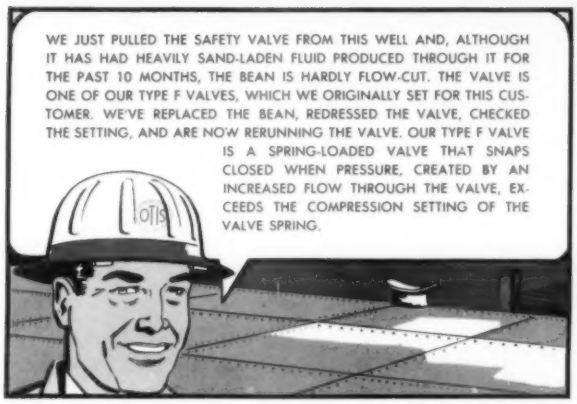
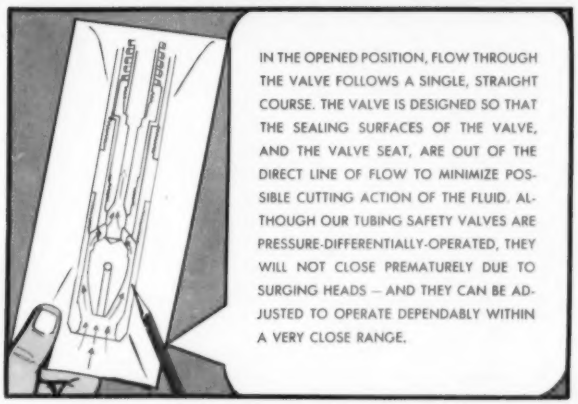

ONE OF THESE OTIS TUBING SAFETY VALVES SHUT IN THIS WELL
WHEN IT THREATENED TO BLOW WILD, AND SAVED US THOUSANDS OF DOLLARS
IN LOST PRODUCTION AND A POSSIBLE SERIOUS FIRE.
First in Pres


THE WELL WAS PRODUCING 2½ MMCFD OF GAS WITH 89 BD OF SAND-LADEN OIL WHEN A LEAK DEVELOPED AT THE FLANGE OF THE MASTER VALVE. AT THE TIME, THE FLOWING PRESSURE WAS 3,100 PSI, SO IT DIDN'T TAKE LONG FOR THE GAS AND SAND TO CUT OUT A SIZABLE HOLE. AS SOON AS THE PRESSURE DIFFERENTIAL EXCEEDED THE VALVE SETTING, THE OTIS VALVE AUTOMATICALLY SNAPPED SHUT.


THIS MORNING WE PUMPED DOWN THROUGH THE SAFETY VALVE AND KILLED THE WELL WITH WATER — THEN BROKE OUT THE MASTER VALVE TO REPAIR THE LEAKY CONNECTION. NOW WE'RE RESETTING THE TREE. WE CALLED OUT OTIS TO PULL, CHECK, AND REDRESS THE SAFETY VALVE BEFORE WE PUT THE WELL BACK ON PRODUCTION. THE VALVE'S PROBABLY O.K., BUT IT'S BEEN DOWN THERE 10 MONTHS AND UNDER OUR SAFETY PROGRAM WE PULL ALL OF OUR SAFETY VALVES PERIODICALLY FOR INSPECTION ANYWAY.


WE JUST PULLED THE SAFETY VALVE FROM THIS WELL AND, ALTHOUGH IT HAS HAD HEAVILY SAND-LADEN FLUID PRODUCED THROUGH IT FOR THE PAST 10 MONTHS, THE BEAN IS HARDLY FLOW-CUT. THE VALVE IS ONE OF OUR TYPE F VALVES, WHICH WE ORIGINALLY SET FOR THIS CUSTOMER. WE'VE REPLACED THE BEAN, REDRESSED THE VALVE, CHECKED THE SETTING, AND ARE NOW RERUNNING THE VALVE. OUR TYPE F VALVE IS A SPRING-LOADED VALVE THAT SNAPS CLOSED WHEN PRESSURE, CREATED BY AN INCREASED FLOW THROUGH THE VALVE, EXCEEDS THE COMPRESSION SETTING OF THE VALVE SPRING.
OTIS


IN THE OPENED POSITION, FLOW THROUGH THE VALVE FOLLOWS A SINGLE, STRAIGHT COURSE. THE VALVE IS DESIGNED SO THAT THE SEALING SURFACES OF THE VALVE, AND THE VALVE SEAT, ARE OUT OF THE DIRECT LINE OF FLOW TO MINIMIZE POSSIBLE CUTTING ACTION OF THE FLUID. ALTHOUGH OUR TUBING SAFETY VALVES ARE PRESSURE-DIFFERENTIALLY-OPERATED, THEY WILL NOT CLOSE PREMATURELY DUE TO SURGING HEADS — AND THEY CAN BE ADJUSTED TO OPERATE DEPENDABLY WITHIN A VERY CLOSE RANGE.

OTIS TUBING SAFETY VALVES, OR "STORM CHOKES" AS THEY'VE BEEN CALLED FOR YEARS, CAN BE RUN IN AND LANDED UNDER PRESSURE IN OTIS NIPPLES MADE UP IN THE TUBING STRING, OR SET IN THE TUBING ON SLIPS FOR WELLS WITHOUT NIPPLES. OTIS TUBING SAFETY VALVES, SET BY OTIS CREWS, HAVE NEVER FAILED TO SHUT IN A BLOWOUT. CALL THE OTIS OFFICE NEAREST YOU AND TALK TO THEM ABOUT INSTALLING TUBING SAFETY VALVES — BEFORE YOU NEED THEM. A SMALL INVESTMENT IN AN OTIS STORM CHOKE TODAY CAN PROTECT YOU AGAINST A POSSIBLE FIRE OR WILD WELL TOMORROW. PLAY IT SAFE WITH A SAFETY PROGRAM — CALL OTIS!
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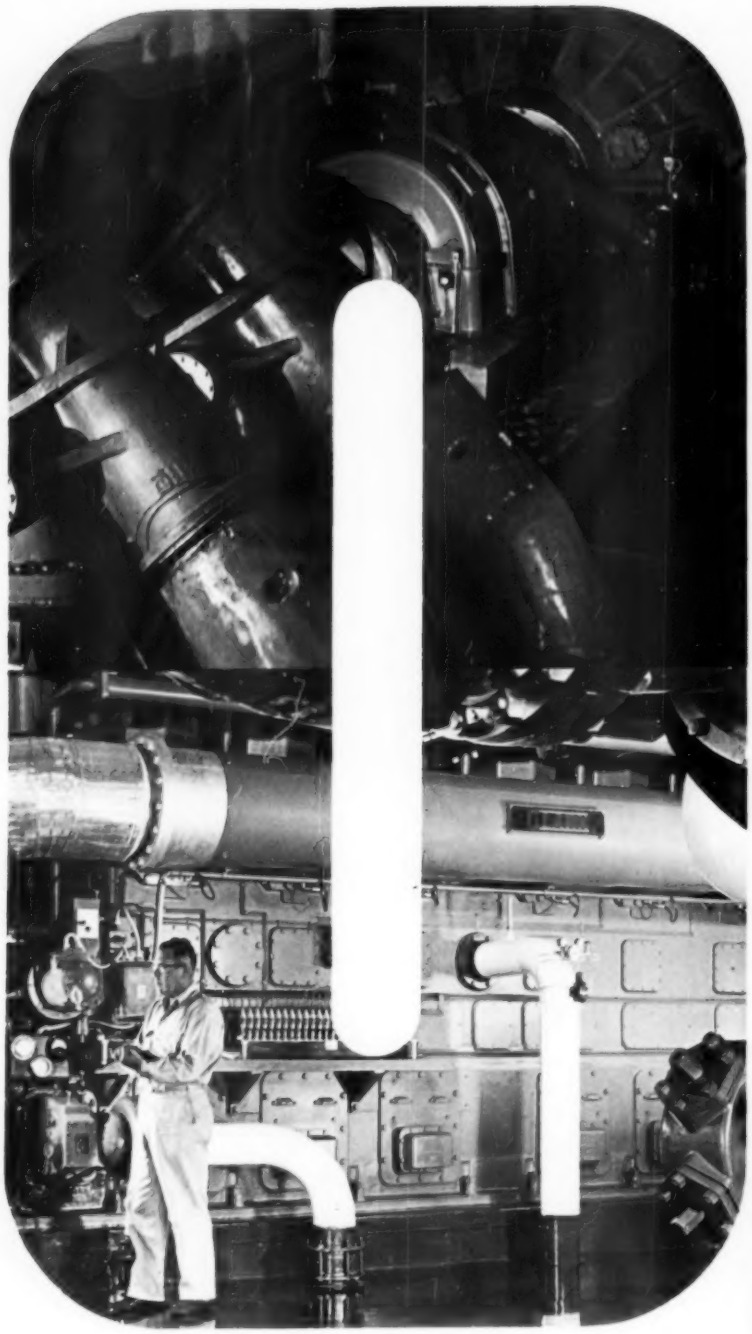

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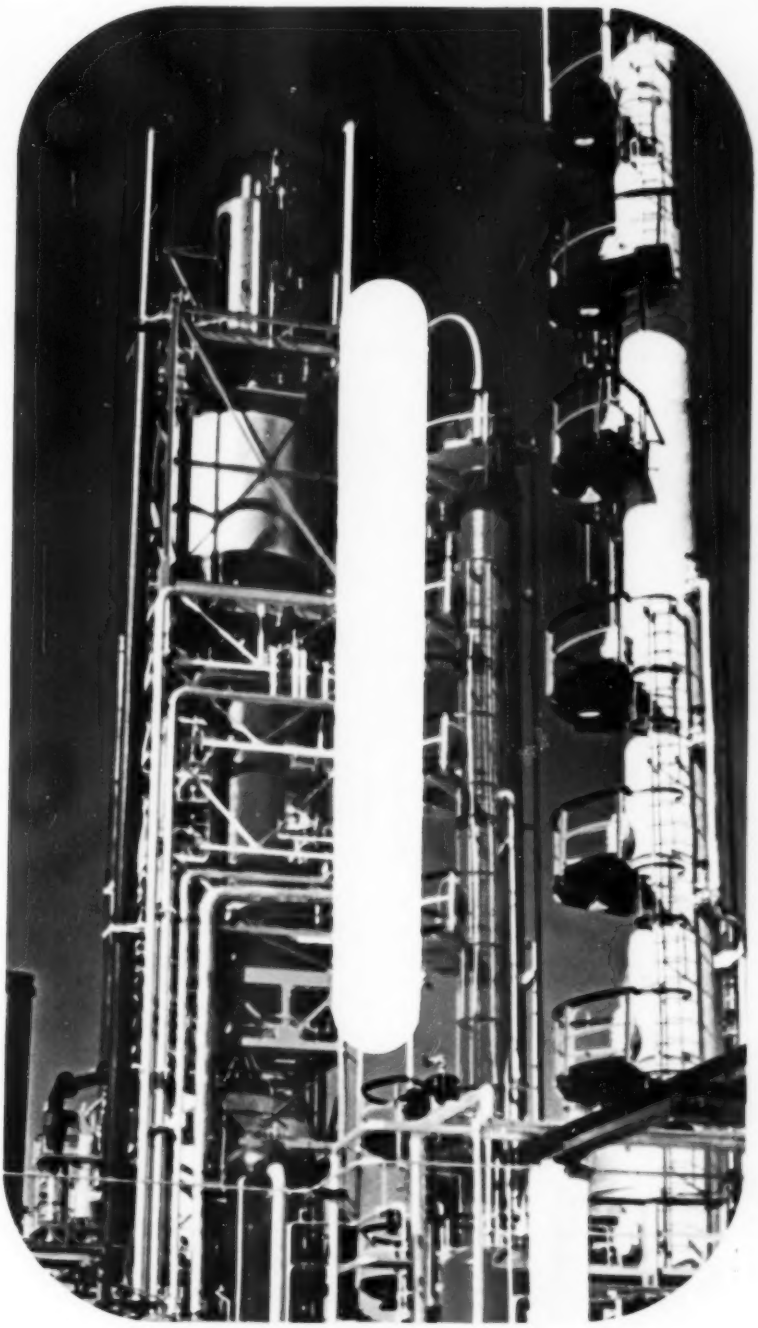

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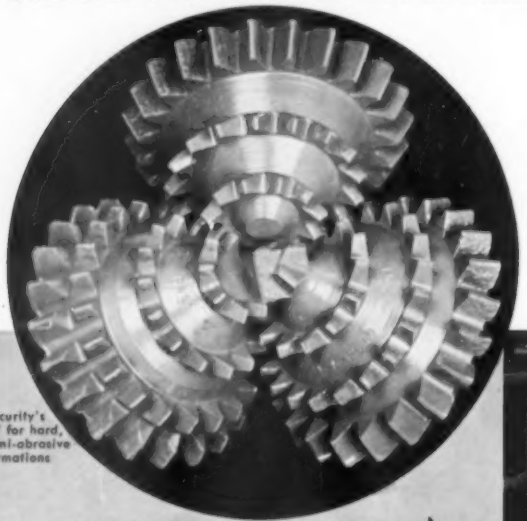

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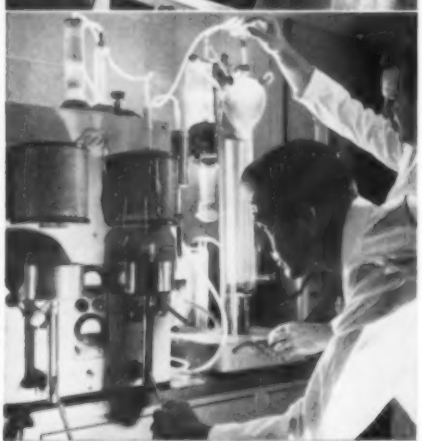

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Winnett area, C NE SE 24-14n-27e. The Otter should be found at 4,000 ft. here. This one is 10 miles southwest of Cat Creek.

Other locations are the 1 Hansen in C NW NE 29-14n-29e; the 1 Coxen in C SW SE 29-15n-29e; the 1 Geunon in C SE SE 14-15n-27e; and, the 1 Government-Hadley-Cox in C SE SE 24-16n-26e. Miles Jackson Drilling Co. has contract for the quintet of wildcats.

Discovery well tested in Nebraska

SPATH FIELD'S discovery well, Shoreline Petroleum Co. 1 Spath, C NE SE 2-13n-55w, Kimball County, western Nebraska, swabbed 14 bbl. of oil hourly on test of the Dakota "J" sand through perforations at 6,251-62 ft.

This Denver basin discovery is 1½ miles east of Deitz field, separated by a dry hole.

New field indicated for Nebraska

THE NEBRASKA SIDE of the Las Animas arch play may have a new pool. Skelly Oil Co. swabbed 7 bbl. of oil per hour at 1 Lewis in SE SE SE 26-1n-32w, Hitchcock County. Recovery is from the Lansing-Kansas City (Pennsylvanian) at 3,862-66 ft.

This new discovery prospect is more than 21 miles northwest of Kansas production.

Successful wildcats

WEST TEXAS

Crockett County: Fred Turner, Jr. 1 Shannon "BB," Tract 22, League 4, Archer CSL Sur., 5 miles southeast of Iraan. IPP 75 BOPD, 33°, GOR 250:1, open hole, Queen sand, top pay 1,928 ft. TD 1,944 ft. Ground elev. 2,792 ft.

Ector County: Cities Service Oil Co. 1 Slator "D," 14-45-T1S-T&P Sur., 3 miles east of Notrees, 1 mile west of Goldsmith field. IPP 129 BOPD, 34.5°, GOR 525:1, Clear Fork 5,748-88 ft. TD 6,588 ft., elev. 3,252 ft.

Garza County: Shell Oil Co. 1 Simms, 875-97-H&TC, 10 miles south of Post, 2½ miles east of Teas field. IPP 221 BOPD, 40°, GOR 93:1, Pennsylvanian 8,078-82 ft. TD 8,570 ft., elev. 2,591 ft.

Midland County: Cities Service Producing Co. 1 Dora Roberts "C-2," 27-41-T-35-T&P Sur., 11 miles southeast of Odessa. IP 711 BOPD, 26/64-in. choke, 40°, GOR 822:1, TP 400 psi., Wolfcamp, top pay 9,234 ft., perforated 9,234-72, 9,844-9,918 ft. TD 12,188 ft., elev. 2,909 ft. New pay in Dora Roberts field.

Pecos County: Phillips Petroleum Co. 1 Harral "A," 6-126-T&STL Sur., 15 miles southeast of Ft. Stockton. IP calculated open flow 53,000 M.c.f. gas, Wolfcamp 14,580-14,670 ft., TD 19,020 ft.

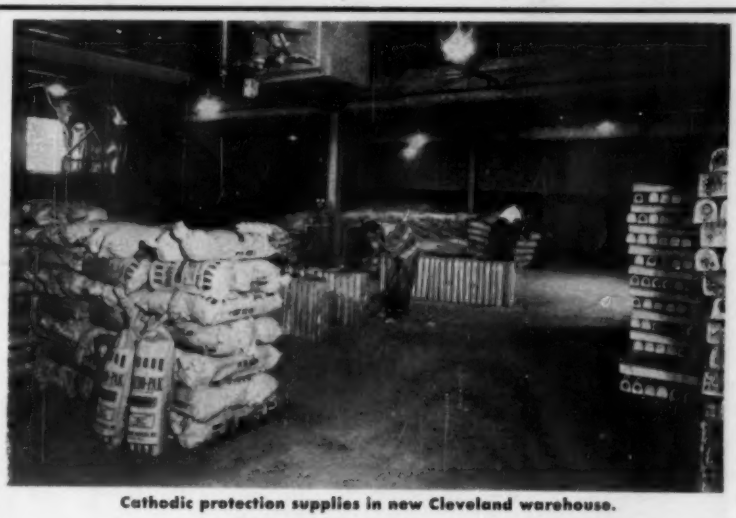
Reeves County: Continental Oil Co. 1 T. A. Kirk, 27-C18-PSL Sur., 10 miles northwest of Pecos, 6 miles northeast of Toyah gas field. IP 148 BOPD, 34.9°, 14/64-in. choke, GOR 415:1, TP 300 psi., Delaware 4,220-28 ft. TD 4,300 ft., elev. 2,684 ft.

C. W. Kilgore 1 J. R. Alexander, 12-58-T2-T&P Sur., 5 miles northeast of Orla. IPP 24 BOPD, 42°, Delaware 2,575-2,635 ft., TD 2,635 ft., elev. 2,985 ft.

Scurry County: Trice Production Co. 1 W. B. Fenton "A," 187-97-H&TC Sur., 8 miles southwest of Snyder. IP 201.9 BOPD, 10/64-in. choke, 41°, GOR 480:1, TP 175 psi., reef pay 6,942-56 ft., elev. 2,393 ft.

Winkler County: Pan American Petroleum Corp. 14 E. E. Brown "E," 5-B11-PSL Sur., 6 miles east of Wink. Triple completion, Fusselman discovery in Emperor field. IP 800 M.M.c.f. gas, Devonian 8,924-9,114 ft.; IP 25 M.M.c.f. gas, Fusselman 9,318-76 ft.; IP 18 M.M.c.f. gas, Ellenburger 11,279-12,-307 ft. TD 11,323 ft., elev. 2,811 ft. All potentials calculated open flow.

Yoakum County: Amerada Petroleum Corp. 7 L. R. Weems, Sec. 403, Blk. D, J. H. Gibson Sur., 3½ miles south of Bronco. IP 299 BOPD, ½-in. choke, 41.7°, GOR 1,099:1, Mississippian 10,-997-11,018 ft. TD 11,043 ft., elev. 3,807 ft. Old well worked over, Mississippian discovery in Bronco-Wolfcamp field.



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More light on producing hydrogen economically ...Tidewater uses heat-resistant Incoloy tubing

The hydrogen plant at Tidewater Oil Company's new Delaware Refinery is the first such unit ever built to supply a refinery's desulfurizer. Capacity is 30 million cubic feet of hydrogen per day.

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Metal temperatures in the reformer furnaces are in excess of 1700° F with internal pressures of the reacting gases sufficiently high to emphasize the need for strength and ductility. To provide these properties, the tubes in one furnace are made of extruded Incoloy* nickel-iron-chromium alloy.

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INCO NICKEL ALLOYS

Thomas B. Hickman

A Gulf Pipeliner Moves Up

. . . to vice presidency after starting 32 years ago as a telegrapher. Hard work and horse sense put him on top.

THOMAS BAILEY HICKMAN of Houston is the new vice president and manager of operations for a "refining" company that doesn't own a refinery.

But he keeps busy enough running the company's network of 4,000 miles of pipelines, which happens to be his business.

Just how the Gulf Refining Co. came to be Gulf Oil Corp.'s pipeline subsidiary is a long and involved story that a lawyer might explain, but the misnomer no longer worries T. B. Hickman.

"Everybody seems to know about it now," he said, "but it certainly took some people a long time to find out."

The change in function actually came about gradually as Gulf moved its refining operations from the old Gulf Refining Corp. to the parent Gulf Oil. By 1956 only two refineries—at Toledo and Cincinnati—remained, and on January 1, 1957, these also were switched over. This left the subsidiary with only the pipelines, which were plentiful enough to keep a company busy, anyway. The system is one of the nation's largest.

Up from East Texas . . . Hickman is a prize example of the American tradition that a country boy can rise to great stature in the business world on hard work, alertness, and horse sense.

Without benefit of college education, he moved ahead in a highly technical industry by learning from others and through correspondence and company training courses.

He was born 55 years ago in tiny Doucette (Tyler County), Tex., was reared at nearby Corrigan, was married at 19, and learned telegraphy while an agent with the HE&WT railroad at Corrigan.

His knowledge of telegraphy led to his first oil company job. He joined the Humble organization at Navasota, Tex., as a pipeline telegrapher.

After 2½ years he went, in 1926, to Lufkin as a telegrapher with the old Gulf Pipe Line Co. He has been a Gulf man ever since.

Hickman stayed at Lufkin for 14 years as a dispatcher and pump-station foreman before moving to Houston in 1940 in the dispatcher's office. Within 2 years, he was the assistant chief dispatcher and in another four was the chief dispatcher.

Because of his knowledge of oil movements, Hickman switched to the crude-purchasing department in 1950 and, after 2 years there, was named superintendent of oil movements for the entire domestic Gulf pipeline system.

In November, Hickman moved up again—this time to the vice presidency of Gulf Refining and manager of operations. He replaced Walter Shannon, who was promoted to director of pipeline engineering for the parent company and transferred to Pittsburgh. Hickman's boss is Gulf Refining's President Lee Irvin.

How it happened . . . Hickman is a lean, easy-going fellow whose warm personality identifies him as the lifelong Texan that he is.

But there is more to him than that.

When asked how a boy with a high-school education can move among the professional elite of the oil industry, Hickman takes a swift imaginary trip back through the years.

"I decided long ago," he says, "that if I was going to be just a telegraph operator, I wouldn't amount to much. I was a great one to watch the other fellow and see what he did and why he did it.

"I took many correspondence courses, most of them in accounting. I did home study on engineering. And I took the company's training courses."

Does this mean a fellow can forge ahead in the world without a college degree?

"I wouldn't say anything against education. I sent two children through college, and it would have been easier for me lots of time if I had had basic training. I certainly wouldn't discourage anybody."

The job ahead . . . The pipeline industry, according to Hickman, has one big problem on the books today: Cutting costs.

Two ways to solve it are automation and eliminating pipe corrosion.

"We're coming to it gradually at Gulf," he said. "It's the trend, and you've got to move with it."

On licking corrosion, Hickman is impressed by the "wonderful progress" made in the past 2 or 3 years.

"We spend a lot of money on it, but it pays off," he says. "But you'll always have the problem, and it's a wonderful field for young engineers."

Does the new manager of operations have any plans, since stepping into Walter Shannon's shoes, for changing things around at Gulf Refining?

"I have a hard man to follow," he replies. "If I can just carry on the established policies, I'll think it's a good job well done."

●

Richard H. Benish and **Gordon D. Cloepfil** have opened offices as geophysical consultants in Denver. Benish was formerly with Rogers Geophysical

▶ ▶ ▶ Personals

Co. and Tennessee Gas Transmission Co. Cloepfil was with Geophysical Service, Inc.

Thomas W. Moore, vice president of Esso Export Corp., has been elected vice president and a director of Esso Standard Oil Co. He succeeds **Glenn W. Poorman,** who has been elected a vice president, director, and member of the executive committee of Esso Export. Moore was with Esso Standard from 1934 to 1954.

MOORE

POORMAN

He served the company as assistant to the general manager of manufacturing and assistant general manager of the supply department before moving to the parent company in 1954. He was assistant manager of Jersey Standard's coordination and petroleum economics department from 1954 to 1957. He became a vice president of Esso Export last year. Poorman had been an Esso Standard vice president since 1956 and a director since 1954. He was general manager of the supply department before that time.

Harold G. Shelton, director of marketing for General Aniline & Film Corp., has been appointed general manager of the dye-stuff and chemical division. He succeeds **Philip M. Dinkins.** Dinkins recently succeeded **John Hilldring** as president of the company. Hilldring is now chairman of the board and chief executive officer.

C. B. Caruthers, Yates field superintendent for Pan American Petroleum Corp. in Iraan, Tex., has been transferred to Levelland, Tex. **D. A. Davidson, Jr.,** field superintendent, has been transferred to Iraan from Henderson, Tex. **C. V. Campbell,** Slaughter field superintendent, Brownsfield, Tex., has been transferred to Andrews, Tex., in the same capacity. **L. W. Reynolds,** formerly Andrews field superintendent, will move to Brownsfield to switch jobs with Campbell. Also **F. F. Kennedy,** Pan American field superintendent in Lubbock, Tex., has been transferred to Liberal, Kans.

Linn Lipsom, The Texas Co., has been named president of the Denver Basin Oil Scouts Association. He succeeds **Bob Disch,** Carter Oil Co. **George Maddox,** Continental Oil Co., has been named vice president, and **Jim McGraw,** Skelly Oil Co., secretary-treasurer. Directors are **Dean Nichols,** Sinclair Oil & Gas Co.; **Jim Cunningham,** Amerada Petroleum Corp.; and Disch.

J. E. Thompson, superintendent of pipeline construction for Natural Gas Pipeline Co. of America, has been named assistant chief engineer. **R. E. Evans,** compressor station construction superintendent, has been named general superintendent of construction. Evans will head both the pipeline and compressor station construction departments. Thompson and Evans had held their former posts since 1953.

Thomas M. Forgan, assistant to the president of Shell de Venezuela, has been named assistant general manager of the company's western division. Forgan joined Shell in London in 1933. He was assistant manager of Venezuelan production operations for Shell in the late 1940's and was later assistant general manager of Shell's Trinidad affiliate. He became assistant general manager of Iranian Oil Refining Co. in 1955. He returned to Venezuela last year.

T. M. Geffen, research group supervisor at Pan American Petroleum Corp.'s Tulsa research laboratory, has been promoted to supervisor of the reservoir - mechanics section. **S. T. Martner,** research group supervisor, has been named supervisor of the field research and interpretation section. In other changes at the Tulsa lab, **A. B. Bennett,** research associate, has been named research group supervisor, seismic model group. And, **C. F. Hadley,** senior research engineer, and **E. B. Stover, Jr.,** group supervisor, have been named research associates.

C. L. Kelly, Roswell, N. M., district superintendent for Pan American Petroleum Corp., has been transferred to Midland, Tex., in the same capacity. The Roswell district office will be closed and eastern New Mexico activities will be handled through the Lubbock, Tex., office. At Midland Kelly succeeds **Fred Baleau,** who has retired. **Dan Currens** and **Bill Smith,** engineers at Roswell, have been transferred to Lubbock. **Charles Marshall, Fred Foell,** and **George Eaton** have been transferred to Farmington, N. M., from Roswell.

Richard Finer, geologist with Northern Natural Gas Co., has been promoted to senior geologist in Calgary.

John L. Lugli has been named senior engineer in The Texas Co.'s petrochemical department in New York. Lugli has been at Texaco's Lockport, Ill., refinery since 1953. He is a graduate of Columbia University.

Thomas A. Roy, Ohio Oil Co., has been elected president of the San Joaquin, California, Geological Society. Other new officers include **B. G. Winter,** Superior Oil Co., vice president; and **Lee K. Jordan,** Kern Oil Co., Ltd., secretary-treasurer.

Tom Dzilsky and **Rafael Rofe,** geologists with Creole Petroleum Corp., have been transferred to Tia Jauna, Venezuela, from Maracaibo, Venezuela. **Larry McGraw,** Creole petroleum engineer, has been transferred to Tia Juana from the Quiriquire area.

Herbert Hoover, Jr., consulting engineer and former under secretary of state, has been elected a director of Monsanto Chemical Co. Hoover founded United Geophysical Co. in 1935 and served as president and later chairman of the company. He was president of Consolidated Engineering Corp. from 1935 to 1946. He became special adviser to the secretary of state in 1953 and was under secretary from 1954 to 1957. He is a graduate of Stanford University and Harvard University Graduate School of Business Administration.

Pan American Petroleum Corp. has moved its Kansas district headquarters to Liberal from Wichita. Making the move will be **G. A. Younie,** district production superintendent in Wichita, now in the same capacity in Liberal. **K. J. Reid,** district exploration superintendent in Oklahoma City, will move to Liberal as exploration superintendent there. Reid's move sets off several changes in Oklahoma City. **John P. Warden** will succeed Reid as district exploration superintendent. **George C. Mahaffy,** formerly district exploration superintendent in Wichita, will replace Warden as Central division landman. Others moving from the Wichita office to Liberal are **W. R. Franey,** district engineer, and **J. W. Mason,** district geologist.

Houston Nomads Name New Officers

B. H. Pickard, fourth from right, of Tuboscope Co., has been elected 1959 president of the Houston Nomads chapter. Other officers are, left to right, J. B. Hughes, Hydril Co., national senior regent; B. J. Gross, W-K-M Manufacturing Co., assistant secretary; F. S. Mims, Mission Manufacturing Co., treasurer; J. C. Woods, National Supply Co., sergeant-at-arms; J. B. Jones, Halliburton Oil Well Cementing Co., secretary; Pickard; John W. Gates, Well Equipment Manufacturing Corp., vice president; A. C. Oden, McEvoy Co., deputy-sergeant-at-arms; and E. W. Louden, Baroid division of National Lead Co., national junior regent. Louden is immediate past president of the chapter. Not pictured is Bruce Barkis, B & W, Inc., assistant treasurer. The new officers will take over January 17.

Harry F. Warnke, plant engineer in Corpus Christi, Tex., for Delhi-Taylor Oil Corp., has been promoted to assistant chief engineer in the manufacturing-engineering department there. **James H. Barnhart,** chemical engineer, will succeed Warnke as plant engineer in Corpus Christi.

John W. Stoker, district production superintendent at Seminole, Okla., for Sinclair Oil & Gas Co., has retired. Stoker joined Sinclair in 1920. He became a district superintendent in 1924. He was manager of drilling and production for Sinclair's Venezuelan subsidiary during the 1940's and was named to his present post in Seminole 2 years ago.

R. A. Cruickshank, general manager of Canadian Devonian Petroleums, Ltd., has been elected chairman of the board of governors of Canadian Petroleum Association. He will complete the term of **Vern Taylor,** who has resigned. Taylor, western region manager of production for Imperial Oil, Ltd., has been transferred to Toronto from Calgary. **J. G. Spratt,** vice president of Triad Oil Co., has been elected first vice chairman of the board. **Bart W. Gillespie,** vice president in charge of operations for Home Oil Co., Ltd., will continue as second vice chairman.

Dr. Pedro Diaz, formerly with Socony Mobil Oil Co. de Venezuela in Anaco, Venezuela, has resigned to join the Venezuelan Ministry of Mines and Hydrocarbons. He will be field inspector in the Jusepin area.

Raymond E. Storms, vice president of San Jacinto Venezolana, C.A., has resigned to join the faculty of the University of Texas. Storms was a petroleum engineer with Mene Grande Oil Co. before joining San Jacinto.

Dr. George Lukk has been named engineering associate by Esso Research & Engineering Co. Lukk joined Imperial Oil, Ltd., Canadian affiliate of Standard Oil Co. (N. J.), in 1948. He moved to Esso Research last year.

Sir Philip Southwell will step down as managing director of Kuwait Oil Co. on June 30. He will be replaced by **William Fraser,** only son of **Lord Strathalmond,** long-time head of British Petroleum and now retired. Southwell will remain as a director of KOC after his retirement. Fraser, a lawyer, has been on the BP staff since 1950. He was in the New York office of BP Trading Co. before being named assistant managing director of the Kuwait company effective January 1. He will become managing director June 30 when Sir Philip retires.

▶▶▶ Personals

R. C. Minton, junior mechanical engineer with Shell Oil Co., has been transferred to Tulsa from Houston.

J. E. Rakaskas has been named Wichita division manager for N. Appleman Co. He will continue as division geologist.

J. A. Lynch, formerly production foreman in Bogota, Colombia, for The Texas Co., has joined American Independent Oil Co. on assignment for 18 months as production foreman in Kuwait.

C. E. Davis, vice president in charge of refining for Shell Oil Co., has been named general secretary for the Fifth World Petroleum Congress. The Congress will meet in New York May 30-June 5.

Charles H. Ohms, formerly at Monsanto Chemical Co.'s Luling, La., plant, has been assigned to the company's inorganic chemicals division, engineering department. **Bruce Ocko** has joined Monsanto's plastics division in Springfield, Mass. **Roger A. Rose** has joined the St. Louis inorganic chemicals division research department.

G. D. Zimmerman has been appointed manager of operations in Argentina for Kerr-McGee Oil Industries, Inc. Kermac is under contract to drill for Carl M. Loeb, Rhoades & Co., New York banking firm which has a development contract with YPF, Argentine Government oil agency. **Paul Romano** will be drilling superintendent. **Bill Stone** and **Howard Watson** have been named rig superintendents.

Dr. Burton C. Belden, associate director of Esso Research & Engineering Co.'s process-research division, has been appointed assistant manager in the office of scientific liaison. Belden has been with the company since 1936. **Wilfred O. Taff,** assistant director in the division, has been named associate director. **Donald L. Baeder,** head of the division's exploratory section, will succeed Taff as assistant director. Also, **William Priestley, Jr.,** has been given a rotational assignment as an acting assistant director in the process research division. **Myles J. Connor, Jr.,** has been appointed an assistant director in the planning engineering division. He is in charge of the division's operations research activities.

Personals

E. B. Wasson, formerly Rocky Mountain division manager in Denver for Cosden Petroleum Corp., and **R. R. Berg,** formerly Cosden's division geologist, have formed Embar

WASSON

BERG

Oil Co. with headquarters in Denver. Embar will handle Cosden's interests in the Rocky Mountain area on a contract basis and will operate its own exploratory program, primarily in Wyoming.

Clement D. Welch, superintendent of Sinclair Pipe Line Co.'s Shawnee, Okla., district, retired January 1. Welch had been with the company since 1916.

Robert C. Heid, engineer with Columbia Gas System Service Corp., has been named assistant senior engineer in the gas engineering department. He has been with the company since 1956.

R. A. (Dick) Baile, Empire Geophysical Co., has been elected 1959 president of the Permian Basin Geophysical Society. Baile was first vice president of the association last year. He succeeds **B. F. Owings,** Forest Oil Corp., as president. Other new officers are **John Clark,** Union Oil Co., first vice president; **John Armstrong,** Cities Service Oil Co., second vice president; **Don Matson,** Midwest Oil Corp., secretary; and **Rollin Phipps,** Lion Oil Co. division of Monsanto Chemical Co., treasurer.

A. H. Mitchell has retired as a director of Carter Oil Co. Mitchell joined Carter in 1926. He had been a director since 1945.

F. G. Schmidt, executive assistant with Sinclair Oil & Gas Co. in Tulsa, has retired. Schmidt joined Sinclair in 1919.

Al Ellsworth has been named drilling superintendent at Bell Petroleum Co.'s new Midland, Tex., office. He moves to Midland from Whittier, Calif. The Midland office will handle Bell's activities in the Permian basin.

T. M. Cady, southwestern region land superintendent for Continental Oil Co., has been promoted to southwestern region special representative of the exploration department, a new position. He will be succeeded by **Wade E. Thomas,** assistant regional land superintendent. Both will continue to headquarter in Fort Worth.

Deaths

John J. Larkin, Tulsa, head of Larkin Torpedo Co. and pioneer oil-well shooter who rode the glycerin wagon for 52 years, died December 30 in a Tulsa hospital. He was 96. Larkin became a moonlighter when he was 17. All wells were shot at night then to avoid heavy patent-rights payments so well shooters were known as "moonlighters." Larkin was active in Pennsylvania fields at the turn of the century. In 1903 he formed Eastern Torpedo Co. at Caney, Kans. Headquarters were later moved to Bartlesville, Okla. During World War I, Larkin served as a dollar-a-year man supervising all nitroglycerin plants and supplies in Oklahoma and Kansas for the Government. Larkin Torpedo Co. was organized in 1926 in partnership with E. L. Connelly. The company did well shooting in Oklahoma, Kansas, Texas, and New Mexico and maintained several nitroglycerin factories. Larkin was active in the business until a few weeks before his death.

Major Alexander Forward, retired managing director of American Gas Association, died December 21 at Coral Gables, Fla. Forward was a member of the Virginia State Corporation Commission before joining AGA in 1923 as secretary-manager. He retired in 1945.

Dr. William Reed Veazey, 75, retired director of Dow Chemical Co., died December 20 in Youngstown, Ohio. Veazey retired in 1953 after 37 years with the company. He had served Dow as coordinator of research, patent and product development, chairman of the executive research committee, and research consultant. He was head of the department of chemistry and chemical engineering at Case Institute of Technology, Cleveland, for many years.

Virgil E. Cottingham, 67, chairman of the North Basin Pools Engineering Committee, Midland, Tex., since 1939, died December 17 in a San Angelo, Tex., hospital. A graduate of the University of Oklahoma, Cottingham was director of production and engineering for the Texas Railroad Commission at one time.

James Arthur Middleton, Sr., 50, engineering assistant to vice president of refining for D-X Sunray Oil Co., died December 26 in a Tulsa hospital of cancer. Middleton had been with D-X Sunray and its predecessor companies since 1935. He was general refining superintendent, mechanical section, before becoming engineering assistant to the refining vice president. He was a graduate of the University of Arizona.

Earl A. Butt, Sr., 87, pioneer Oklahoma oil man, died December 27 in a Wynnewood, Okla., hospital. Butt was at one time president of Golden Gasoline Co., Missouri Petroleum Co., and Massachusetts Petroleum Co. A pioneer Oklahoman, he made the run into the territory in 1889 and the Cherokee Strip run in 1893.

George Reid, 63, southwestern research manager for Petroleum Week and National Petroleum News, died December 24 in Houston of a head injury received in a fall. Reid was a former editor of Petroleum Refiner and was at one time executive secretary of the Gulf Coast Refiners Association.

Howard G. Texter, retired chief field engineer of National Supply Co.'s Tulsa division, died December 28 at his home in Chapala, Mexico, after a stroke. He was 67. Texter moved to Mexico from Tulsa after his retirement last year.

James L. Neuner, 69, operator of the old Bolene Refining Co. before its purchase by Champlin Oil & Refining Co., died December 28 in an Enid, Okla., hospital.

E. E. Colvin, 66, Maud, Okla., independent operator, died December 22 in a Shawnee, Okla., hospital.

Boyd N. Adkins, 73, retired foreman with Sinclair Pipe Line Co., died December 27 in Conroe, Tex., after a heart attack.

Clinton G. Rogers, 45, Houston independent operator, died December 26 in a Houston hospital after a heart attack.

Edmund E. Lemon, 82, retired drilling contractor, died recently in a Denver hospital after a short illness.

Year-end trend shows higher prices

BY JOHN C. CASPER

PETROLEUM PRICES were firmer at the end of 1958 than at the close of 1957. In many cases, markets were better than they had been all year.

First, let's take a look at No. 2 heating oil. The market for this product depends heavily on weather conditions in northern and northeastern states. Both demand and available supply are reflected in price quotations for this fuel.

The weather was warm last January. Also, stocks were up. The distillate-stock total was 22,000,000 bbl. higher at the end of January 1958 than a year earlier and was 36,000,000 bbl. above the level for January 1956. The result was a general decline in distillate prices ranging from 0.375 to 0.5 cent a gallon in the first month of the year.

This pressure remained on distillate prices for the first half of the year or until correction was made in supply. Some market observers expressed the belief that the distillate supply was overcorrected last summer and that there was a chance of a shortage if winter came in early and cold.

No one will know for sure if they were right, because the early part of the heating season was very mild. The relatively low level of distillate stocks left plenty of space in clean storage tanks for the expected accumulation of gasoline stocks.

But the mild weather that cut distillate demand helped extend the period of high gasoline consumption. This late demand delayed the seasonal buildup of gasoline stocks. Gasoline inventories increased very little until the end of November.

Here is the score for clean-product stocks at the end of November. Gasoline was down almost 12,000,000 bbl. Kerosene was off almost a million, and distillate about 6 million.

Real winter weather did not start until after the first of December, but low temperatures at that time brought sharp drops in distillate stocks. Reductions for middle distillate averaged better than 10,000,000 bbl. a week for the 2 weeks ended December 19. High demand and lower stocks produced firmer prices for heating oils in all of the important marketing areas.

Residual markets . . . For most of the year, Group 3 quotations for heavy fuel were based on Gulf Coast prices. Reduced operations at steel mills and the low level of industrial activity had removed much of the normal market for Group 3 resid.

Some heavy fuel was charged to coking units, but a large volume was shipped by rail to the Gulf Coast.

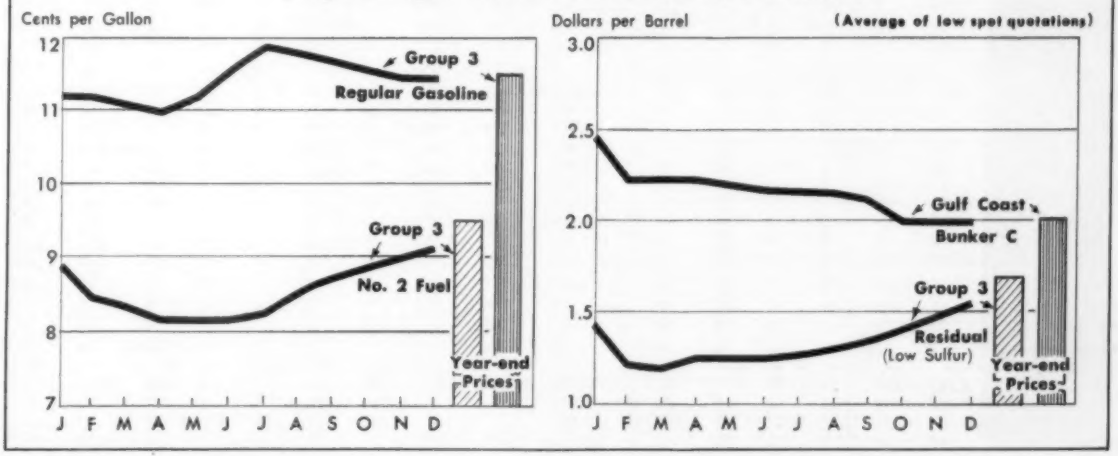
Increased industrial activity in the last half of the year boosted the inland market for resid. The result was a sharp upward trend for Group 3 prices in the late months of the year. Low-sulfur grades were selling for $1.70 at the end of the year.

Oversupply of Bunker C on the West Coast resulted in shipment of 2.5 million barrels to the East Coast in the first 10 months of 1958. To sell at regular quotations on the East Coast, this material had to be priced very low at loading points.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,130,925	UP	23,375	UP	152,363
Crude stocks	262,861,000	UP	2,142,000	DOWN	14,861,000
Completions	1,223	UP	137	UP	51
Refinery runs	8,165,000	UP	343,000	UP	289,000
Gasoline stocks	181,635,000	UP	3,036,000	DOWN	12,530,000
Kerosine stocks	26,155,000	DOWN	1,781,000	DOWN	2,599,000
Distillate stocks	130,410,000	DOWN	7,772,000	DOWN	21,359,000
Residual stocks	61,629,000	UP	961,000	UP	2,723,000
Four-product stocks	399,829,000	DOWN	5,556,000	DOWN	33,765,000
Total imports	2,031,600	UP	124,500	UP	324,100

Opening Prices for 1959 Are Firmer



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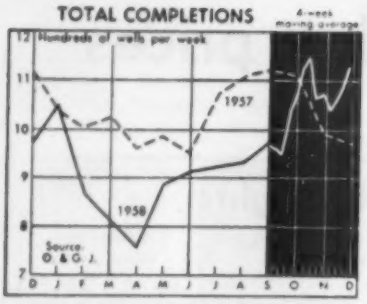
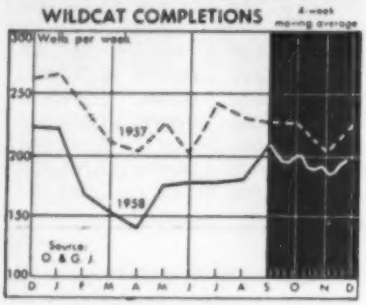




Active Rotary Rigs*

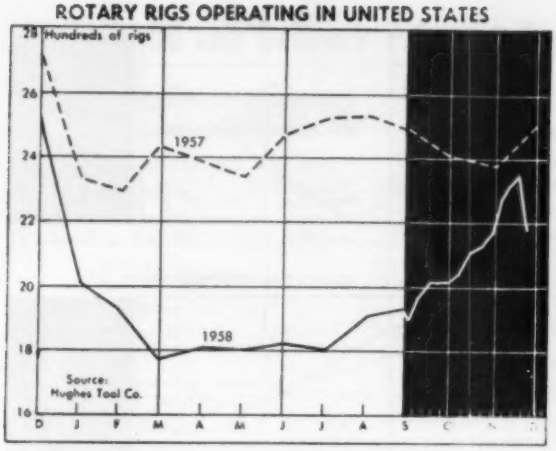
	12-29-58	12-22-58	12-30-57
Alabama	10	10	8
Arkansas	24	23	16
Arizona	...	1	1
California	85	89	94
Colorado	38	39	35
Florida	...	...	1
Georgia	...	...	...
Illinois	49	55	30
Indiana	7	9	4
Iowa	3	3	2
Kansas	151	180	138
Kentucky	8	9	6
Louisiana	325	326	377
North	36	37	39
S.-Inland waters	138	135	(‡)
S.-Land	113	115	260
Offshore	38	39	78
Maryland	2	...	1
Michigan	9	12	7
Missouri	1	1	...
Montana	19	21	31
Mississippi	65	70	47
Nebraska	20	20	30
Nevada	...	...	...
New Mexico	97	101	142
New York	...	1	1
North Dakota	32	36	47
Ohio	2	3	1
Oklahoma	234	263	227
Oregon	...	...	...
Pennsylvania	9	9	8
South Dakota	...	...	1
Texas	866	953	952
S. Inland waters	6	6	(‡)
S.-Land	180	219	215
Offshore	1	2	2
North-East	189	202	(†)
West Central	326	358	(†)
West	164	166	(†)
Utah	34	38	48
Washington	...	...	1
West Virginia	3	2	2
Wyoming	78	82	67
Virginia	...	...	...
Total U.S.	**2,171**	2,356	2,325
Western Canada	193	208	192
Eastern Canada	...	1	1
Grand total	2,364	2,565	2,518

*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land.

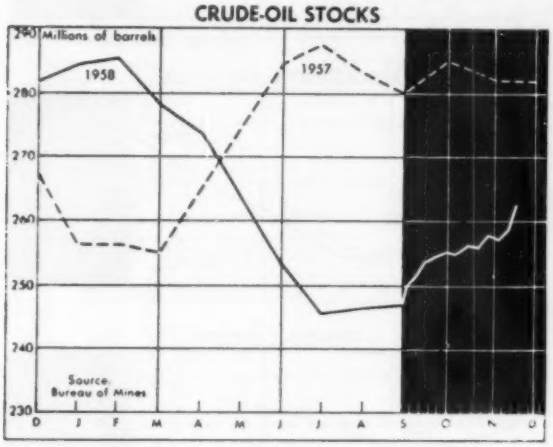
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 27, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	0	0	0	0	0	0	0	76	78	0	0	0	0	0	30	28
Arkansas	27	16	0	3	8	0	88,769	836	1,108	5	0	0	0	5	163	215
California	18	6	0	0	12	0	82,416	1,476	2,238	11	0	0	0	11	368	527
Colorado	18	1	0	2	15	0	96,856	836	855	9	0	0	0	9	485	549
Illinois	46	19	0	1	26	0	92,875	2,419	2,686	10	1	0	1	8	449	628
Indiana	23	14	0	0	9	0	39,193	877	754	4	1	0	0	3	307	157
Kansas	101	48	1	3	48	1	341,555	4,022	4,223	22	4	0	1	17	844	833
Kentucky	178	15	0	1	162	0	129,451	2,137	1,494	1	0	0	0	1	176	310
Louisiana	82	47	2	2	30	1	591,709	3,523	3,853	18	1	0	0	17	531	676
North	37	19	0	0	18	0	138,820	1,384	1,447	13	0	0	0	13	243	211
South	38	24	2	2	10	0	394,482	1,720	1,736	5	1	0	0	4	261	374
Offshore	7	4	0	0	2	1	58,407	419	670	0	0	0	0	0	27	91
Michigan	13	4	0	6	3	0	38,454	436	447	4	1	0	1	2	145	152
Mississippi	8	4	0	1	3	0	70,318	398	388	3	1	0	0	2	174	196
Montana	13	7	0	0	6	0	55,806	338	433	6	2	0	0	4	136	185
Nebraska	18	3	0	0	15	0	92,903	728	887	9	0	0	0	9	348	476
New Mexico	26	16	1	3	6	0	97,554	1,910	2,129	5	0	1	0	4	266	267
West	15	7	1	1	6	0	42,227	937	920	5	0	1	0	4	103	102
East	11	9	0	2	0	0	55,327	973	1,209	0	0	0	0	0	163	165
New York	0	0	0	0	0	0	0	544	467	0	0	0	0	0	44	11
North Dakota	4	2	0	0	2	0	25,201	442	316	2	0	0	0	2	135	147
Ohio	41	18	0	12	10	1	117,469	1,049	1,115	2	0	0	0	2	23	18
Oklahoma	144	72	1	9	57	5	450,066	6,354	6,235	16	1	0	0	15	854	747
Pennsylvania	0	0	0	0	0	0	0	573	586	0	0	0	0	0	21	47
Texas	445	215	29	22	177	2	1,909,621	18,065	21,337	108	9	6	0	93	3,634	5,006
Dist. 1	28	13	0	2	13	0	70,993	996	1,246	8	0	0	0	8	367	431
Dist. 2	12	5	3	0	4	0	82,733	726	764	5	0	1	0	4	196	255
Dist. 3	50	19	8	3	19	1	295,445	1,320	1,646	7	1	1	0	5	284	442
Dist. 4	24	2	5	2	15	0	122,569	1,160	1,417	13	1	0	0	12	351	444
East	27	12	6	0	9	0	172,307	1,220	1,359	9	0	3	0	6	332	387
Dist. 7-B	73	32	1	3	37	0	221,075	2,575	2,903	25	2	0	0	23	699	975
West	129	85	2	3	39	0	585,516	5,153	6,071	24	3	0	0	21	706	871
Dist. 9	63	33	0	3	27	0	169,434	3,585	4,523	10	2	0	0	8	573	1,087
Dist. 10	39	14	4	6	14	1	189,549	1,330	1,408	7	0	1	0	6	126	114
Utah	3	1	0	0	2	0	18,212	383	267	2	0	0	0	2	84	124
West Virginia	0	0	0	0	0	0	0	756	692	0	0	0	0	0	22	34
Wyoming	15	6	0	1	8	0	51,841	762	863	1	0	0	1	0	259	310
Miscellaneous	0	0	0	0	0	0	0	94	131	0	0	0	0	0	84	113
Total U. S.	**1,223**	514	34	66	599	10	4,390,269	49,034	53,582	**238**	21	7	4	206	9,582	11,756
Prev. week	1,086	530	34	54	409	59	4,484,936	...	...	211	19	7	8	177	...	...
Cum. 1958	49,034	24,150	1,127	3,629	18,761	1,367	197,278,869	...	...	9,582	919	158	266	8,239	...	...
Western Canada	58	44	0	3	11	0	310,593	2,449	2,886	11	1	0	1	9	638	827

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	12-20-58	12-13-58	12-21-57
Pennsylvania	2,693	2,720	3,085
Other Appalachian	1,628	1,731	1,704
Illinois, Indiana, Michigan	9,999	10,038	11,292
Nebraska and North Dakota	2,475	2,340	2,796
Kansas	10,348	10,233	10,578
Oklahoma	16,762	17,033	19,921
Arkansas	2,266	2,413	2,879
Louisiana	16,991	16,949	19,389
North	2,931	2,971	2,906
South	14,060	13,978	16,483
Mississippi, Alabama, Florida	2,272	2,273	2,811
New Mexico	8,446	8,225	9,545
Texas	116,543	115,728	123,768
East Texas	8,563	8,585	8,877
West Texas	58,111	56,711	56,387
Texas Gulf	19,813	20,499	24,440
Other Texas	30,056	29,933	34,064
Wyoming	13,132	12,961	12,751
Other Rocky Mountain	9,467	9,033	7,106
California	33,857	32,819	34,334
Foreign	15,982	14,223	15,763
Total	262,861	258,719	277,722

*Bureau of Mines.

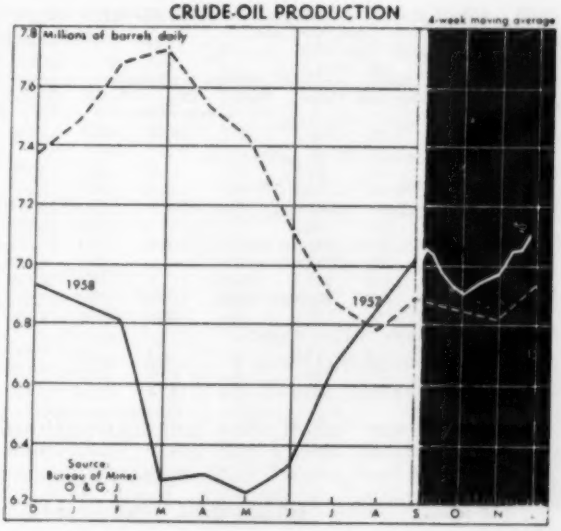
DAILY AVERAGE PRODUCTION FOR WEEK

	December 27, 1958 — Crude oil	Lease condensate	Total	Dec. 20 total
Alabama	16,000	.....	16,000	15,900
Arkansas	86,400	125	86,525	80,300
California	853,200	.....	853,200	855,800
Colorado	129,800	.....	129,800	128,700
Eastern	40,100	.....	40,100	42,900
Florida	1,225	.....	1,225	1,225
Illinois	222,900	.....	222,900	225,100
Indiana	32,700	.....	32,700	33,900
Kansas	†324,500	.....	†324,500	†323,675
Kentucky	65,400	.....	65,400	65,000
Louisiana	829,075	93,975	923,050	923,025
North	110,575	3,875	114,450	114,425
South	718,500	90,100	808,600	808,600
Michigan	22,900	.....	22,900	25,400
Mississippi	114,575	4,875	119,450	119,450
Montana	77,600	.....	77,600	77,000
Nebraska	60,000	.....	60,000	59,700
Nevada	100	.....	100	100
New Mexico	275,500	6,300	281,800	281,800
North Dakota	39,000	.....	39,000	38,200
Oklahoma	†565,300	.....	†565,300	†540,700
Texas	2,772,000	66,000	2,838,000	2,838,000
Dist. 1	45,000	1,450	46,450	46,450
Dist. 2	122,000	8,000	130,000	130,000
Dist. 3	381,000	33,000	414,000	414,000
Dist. 4	197,000	7,500	204,500	204,500
Dist. 5	31,000	400	31,400	31,400
Dist. 6	121,000	7,300	128,300	128,300
East Texas field	160,000	.....	160,000	160,000
Dist. 7-B	141,000	100	141,100	141,100
Dist. 7-C	139,000	3,850	142,850	142,850
Dist. 8	1,116,000	2,000	1,118,000	1,118,000
Dist. 9	216,000	1,500	217,500	217,500
Dist. 10	103,000	900	103,900	103,900
Utah	95,800	.....	95,800	97,600
Wyoming	335,500	.....	335,500	334,000
Others	†75	.....	†75	†75
Total U. S.	6,959,650	171,275	**7,130,925**	7,107,550
Change from previous week up	.....		**23,375**	.....

Total U. S. Prod.-Jan. 1-Dec. 27 ..... 2,410,779,725 bbl.
Same period last year (crude plus cond.) ..... *2,591,188,988 bbl.

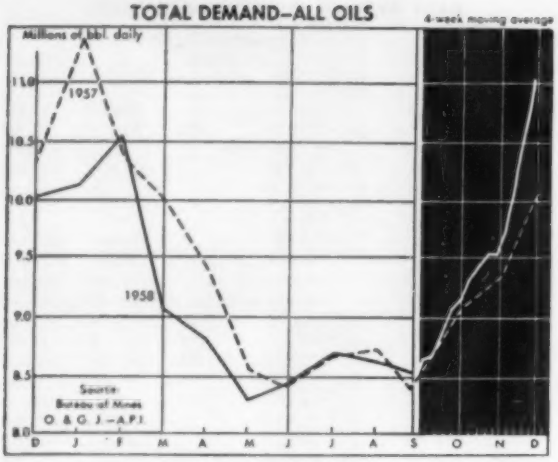
*Includes 50,955,305 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Washington.

CRUDE-OIL PRODUCTION

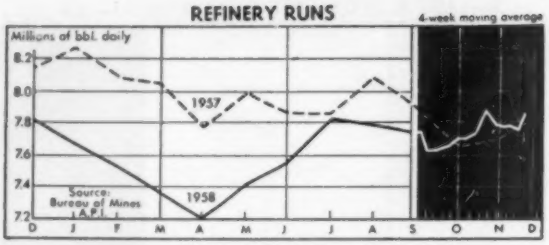


REFINING

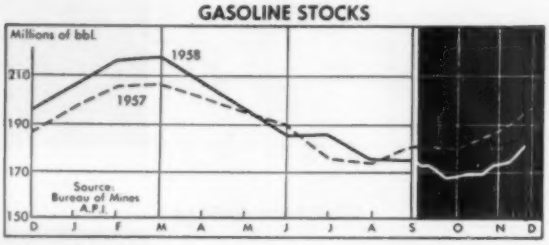
TOTAL DEMAND—ALL OILS



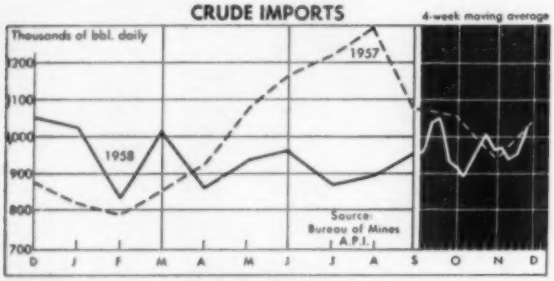
REFINERY RUNS



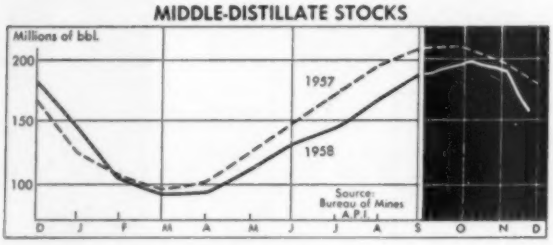
GASOLINE STOCKS



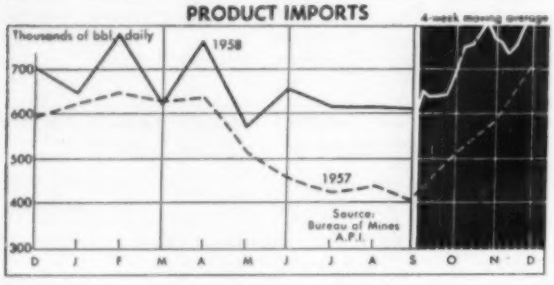
CRUDE IMPORTS



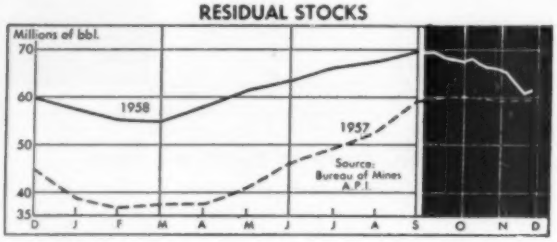
MIDDLE-DISTILLATE STOCKS



PRODUCT IMPORTS



RESIDUAL STOCKS



API REFINERY REPORT—DECEMBER 26, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,202	540.3	26.1	383.3	178.7	41,238	10,551	46,762	10,725	1,201	499.9	38.7	349.4	194.5
Appalachian:														
District 1 ..	105	42.1	8.3	23.2	11.4	4,790	467	3,071	318	108	44.6	5.4	24.9	10.8
District 2 ..	100	45.4	4.4	22.6	14.7	2,487	479	1,205	179	105	55.2	7.7	18.6	16.8
Ind., Ill., Ky. ..	1,495	761.8	72.3	364.1	231.4	30,514	5,935	22,921	4,341	1,439	734.1	83.1	326.7	218.4
Minn., Wis., Dak.	111	56.1	5.3	32.7	12.3	6,774	1,121	6,445	556	105	52.3	6.0	25.2	11.6
Okla., Kans., Mo.	751	451.6	18.1	206.4	40.4	17,311	1,467	11,007	987	731	415.2	12.6	202.7	38.6
Inland Texas ..	298	212.0	4.3	47.1	25.2	7,142	346	2,254	2,222	266	207.2	9.9	49.6	23.3
Tex. Gulf Coast	1,876	977.4	136.9	517.3	214.0	24,139	3,131	12,745	6,435	1,807	906.2	124.9	489.3	213.4
La. Gulf Coast	689	370.4	88.6	155.3	53.4	12,377	1,509	5,728	1,655	599	351.3	51.2	149.7	42.7
N. La. and Ark.	91	37.6	5.9	22.4	5.9	4,651	575	2,372	112	95	38.9	7.5	20.3	8.0
Rocky Mtn.:														
New Mexico	25	13.9	0.4	4.3	2.2	632	25	139	38	24	11.9	0.3	4.5	3.0
Other Rky. Mt.	271	129.1	1.1	65.6	35.0	5,033	229	2,885	827	256	126.6	4.0	63.1	36.2
West Coast ...	1,151	520.0	2.7	185.4	316.4	24,547	320	12,876	33,234	1,080	512.4	4.9	161.6	324.6
Dec. 26, 1958	8,165	4,157.9	374.4	2,029.7	1,141.0	181,635	26,155	130,410	61,629	7,816	3,955.8	356.2	1,885.6	1,141.9
Dec. 19, 1958	7,822	4,050.9	350.7	1,982.7	1,079.0	178,599	27,936	138,182	60,668	.....	.....	.....	.....	.....
Dec. 27, 1957	7,876	3,989.4	372.7	1,885.7	1,145.6	194,165	28,754	151,769	58,906	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.50-11.625
Premium (99 octane)	14.50-14.625
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.25
Regular (92 octane)	10.50
Premium (97 octane)	11.625
Premium (98 octane)	11.75
California (rack) (Los Angeles):	
Regular (88 octane)	12.25
Premium (94 octane)	13.25
Premium (98 octane)	14.25
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.25-10.50
Diesel oil (58 d.i. and above)	10.00-10.25
Distillate No. 1	10.00-10.25
Distillate No. 2	9.25-9.50
Gulf Coast (cargoes):	
Kerosine 41-43	9.625
Distillate No. 2	9.125
New York Harbor (barges):	
Kerosine 41-43	11.00
Distillate No. 2	10.50
Diesel fuel, 48-52 d.i.	10.75
Caribbean area (cargoes):	
Distillate No. 2	9.125

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank car	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.52	....	$2.62	2.06
21-21.9	2.50	2.55	....	2.64	2.11
22-22.9	2.60	2.58	....	2.66	2.16
23-23.9	2.69	2.61	$3.44	2.68	2.21
24-24.9	2.78	2.64	3.46	2.70	2.26
25-25.9	2.87	2.67	3.48	2.72	2.31
26-26.9	2.96	2.70	3.50	2.74	2.36
27-27.9	3.06	2.73	3.52	2.76	2.49
28-28.9	3.11	2.76	3.54	2.78	2.54
29-29.9	3.16	2.79	3.56	2.80	2.59
30-30.9	3.22	2.82	....	2.82	2.63
31-31.9	3.27	2.85	....	2.84	2.67
32-32.9	3.33	2.88	....	2.86	2.71
33-33.9	3.38	2.91	....	2.88	2.75
34-34.9	3.44	2.94	....	2.90	2.79
35-35.9	3.49	2.97	....	2.92	2.83
36-36.9	3.55	3.00	....	2.94	2.87
37-37.9	3.60	3.02	....	2.96	2.89
38-38.9	....	3.04	....	2.98	2.91
39-39.9	....	3.06	....	3.00	2.93
40-44.9	....	3.08	....	3.02	2.95

*Top prices on other Oklahoma (sweet) postings vary from $3.15 to $3.01 a barrel. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 9-30-58: East of California, January 3-10, 1957; Pennsylvania Grade, 6-18-58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Ville Platte	3.30
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	3.90-4.05
Middle District	3.72-3.87
Southwest Pennsylvania	3.43-3.58
West Virginia	3.25-3.40
Buckeye Grade	3.25
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.66
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachequero, flat, 15°-16°, Las Piedras*	1.93

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SEALED BIDS will be received until 2:00 P. M. CST January 15, 1959, and opened at that time in the Office of the Fort Berthold Indian Agency, New Town, North Dakota, for the leasing of 8723.84 acres of allotted Indian land located in McKenzie, Dunn and Mercer Counties, North Dakota, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Fort Berthold Indian Agency at New Town, North Dakota or call MA 7-4340.

LEGAL

SEALED BIDS will be received until 10:00 A.M. Mountain Standard Time, January 13, 1959, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, for oil and gas leases, on 45 tracts of tribal lands, totaling approximately 102,690.32 acres, located in San Juan County, New Mexico. Details of the lease offering and filing of bids may be obtained by addressing an inquiry to the General Superintendent, Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, P. O. Box 777, Salt Lake City 10, Utah. NOTICE IS HEREBY GIVEN that approximately 80 acres of land in One parcel within the known geologic structure of the Ashley Creek Field, Uintah County, Utah, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 1:00 P.M., M.S.T., Thursday, February 5, 1959, when bids will be opened. Full details of the lease offering and how and where to submit bids, may be obtained from the Land Office Manager, 31 Federal Building, Salt Lake City, Utah.

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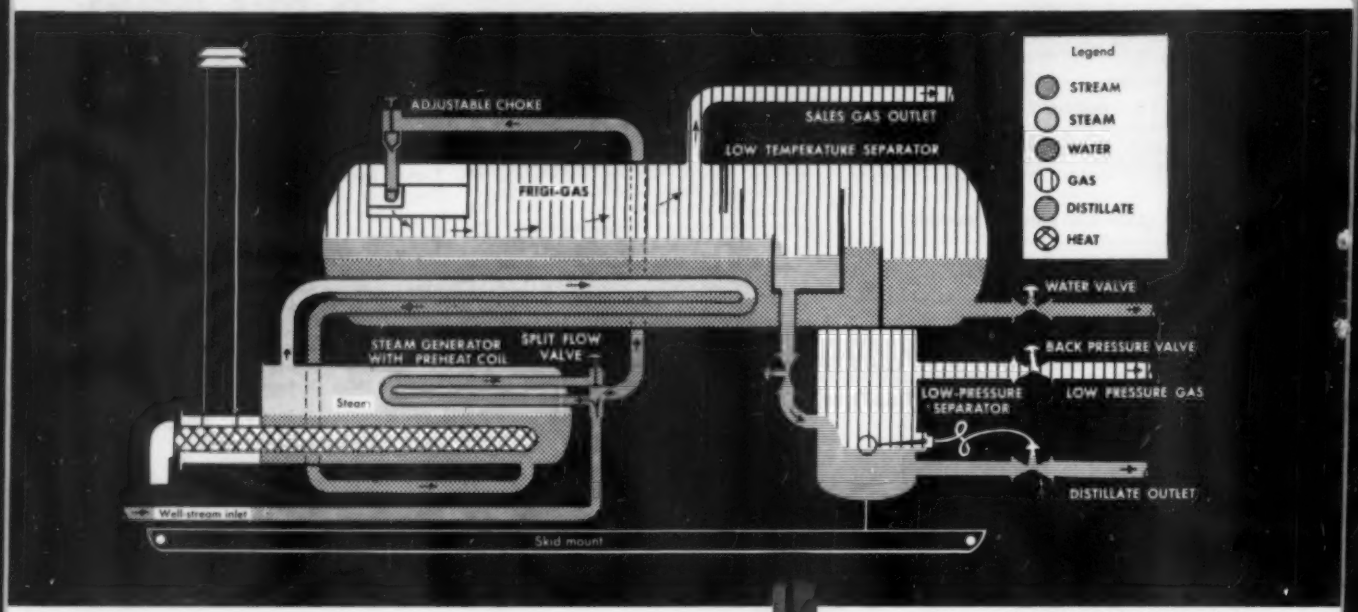

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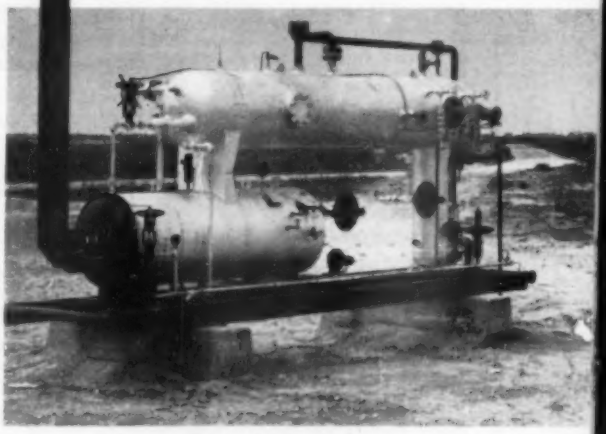
National designed this distinctly new and improved method for handling high to moderate pressure distillate wells, particularly when flow rate requirements vary over a wide range of operations, i.e. rates from one tenth (1/10) of a million per day up to rated recommended capacities, with ability to care for wide differences of throughput during the same 24 hour period.

The National Frigi-Gas Unit consists of a low temperature oil-gas-water separator with steam-heated base, choke and automatic controls; a steam generator with preheat coil; a low-pressure flash separator with automatic controls and all piping, valves, gages, skids, safety features and all other accessories.

- Single heat source
- Low operating temperature
- Produces clean, dry gas
- Disposes of water separately
- Maximum liquid recovery at lowest attainable separation temperature
- Collects distillate separately
- Will handle larger quantities of paraffin, drilling mud and other foreign substances than conventional designs
- Another "PACKAGED UNIT" by National



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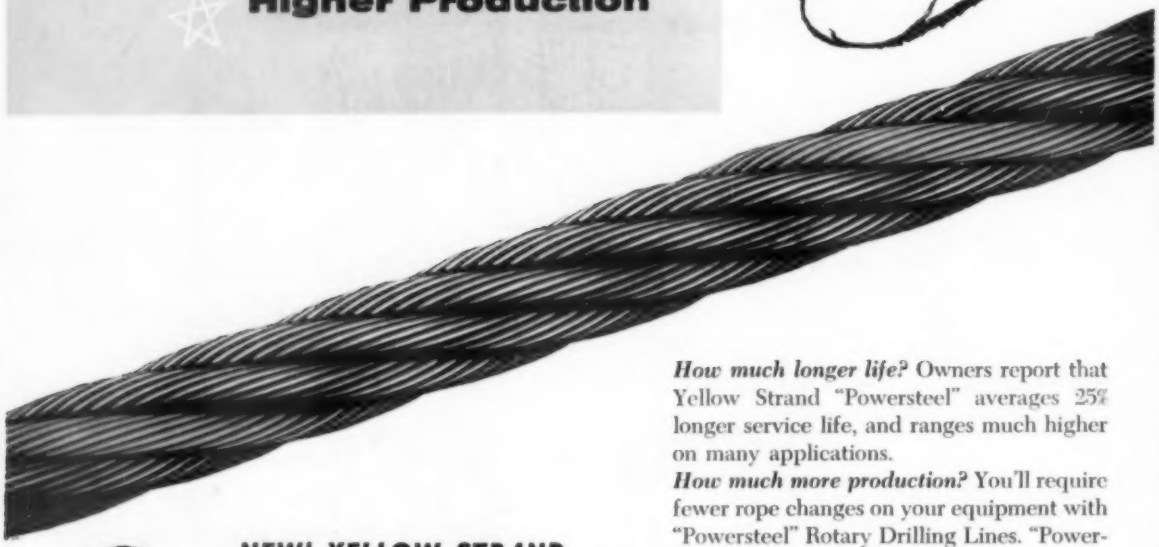

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